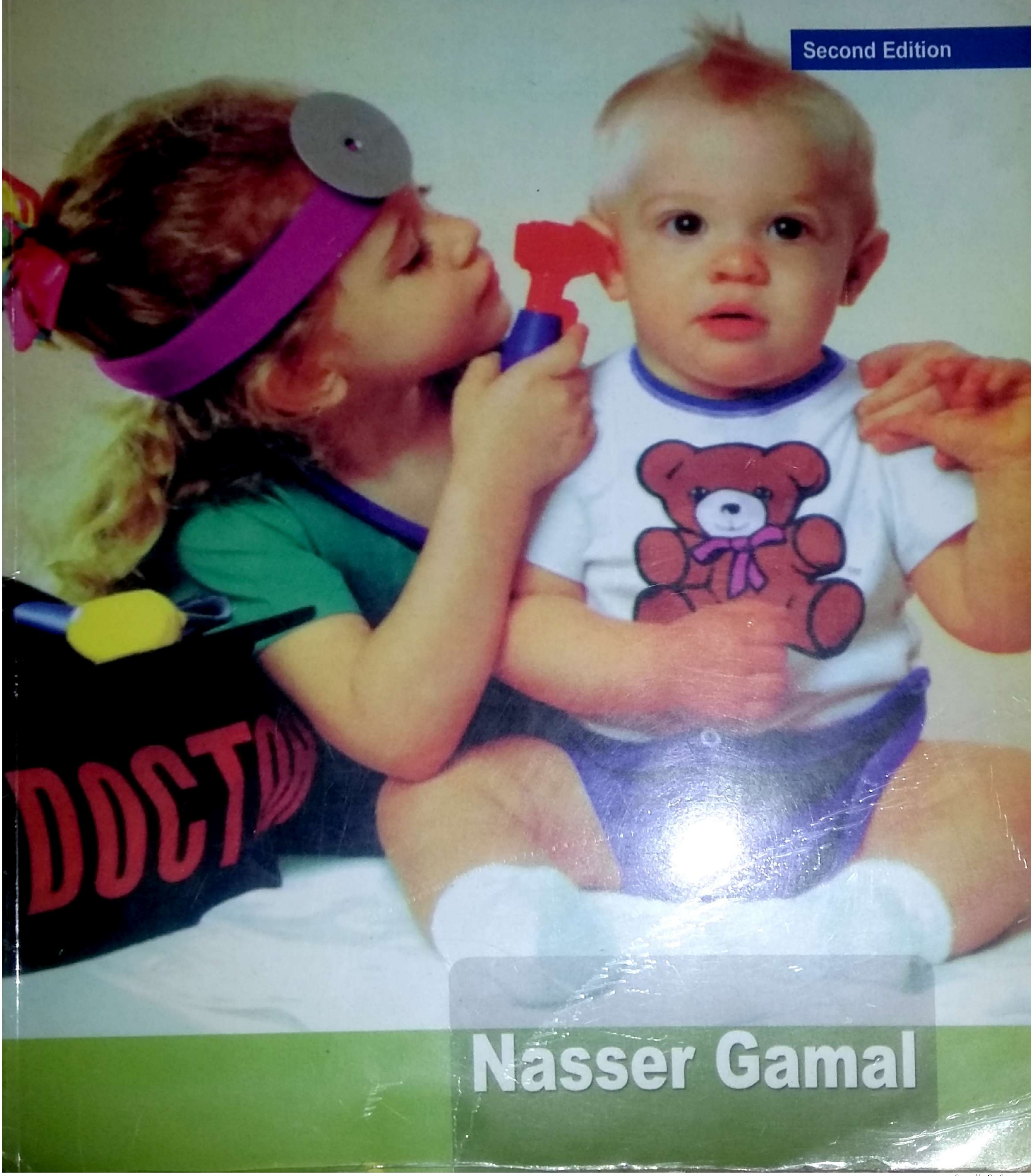
# BASIC CLINICAL
# PEDIATRICS

Second Edition



Nasser Gamal

# Contents

# History Taking

# History Taking :

In infants and young children , history is often obtained from parents but older children should be encouraged to provide the history by themselves.

## 1) Personal history :

A.Name

B.Age :

**Newborn ( first 4 weeks of life ):**
Problems of this age : prematurity – low birth weight-congenital malformations- birth injuries – infections ( as TORCHS , septicemia)

**Infants ( 4 weeks – 2 years ) :**
Problems of this age : Developmental disorders – infections ( period of immunization)- nutritional problems.

**Early childhood ( Toddler age or preschool age ) : 1-4 years :**
Problems of this age : trauma – poisoning- infections- diseases as minimal change nephrotic syndrome

**Late childhood ( school age ) 5-12 years :**
Problems of this age : Infections- accidents – diseases as rheumatic fever , acute glomerulonephritis ( non suppurative complications of streptococcal infection) , Malignancy .

**Adolescence ( 12-20 years) :**
Psychological disorders and problems of puberty are important in this age group.

C- Sex : some diseases occur mainly in one sex e.g.

Males : are more liable to :
- Hemophilia A, B.
- Duschenne muscle dystrophy.
- G6PD deficiency.

Females : are more liable to :
- Rheumatic chorea
- Rheumatoid arthritis
- SLE

D- Residence : e.g. Bilharziasis and fasciola in rural areas.
E- Date of admission .

## 2) Complaints and their duration :

- Obtain the complaints from the parent or the child if cooperative.
- Do not interrupt the parents.
- Do not suggest specific symptoms .
- Ascertain the complaint : make sure you understood what the parents mean.
- List the complaints and their duration in order of occurrence.

## 3) Present History ( history of present illness) :

- When was he healthy last time?
- What was the first complaint to appear ?
- The type of onset : either acute or gradual ?
- Analyze each complaint e.g.:

For vomiting : onset , precipitating factors , relation to meals , color of vomitus , response to treatment if given.

For diarrhea : onset , frequency , consistency and volume of stools , presence of blood .

- The course of the disease ( progressive, stationary or regressive).
- Ask for complaints related to other systems ( system review).
- Any investigations done or any treatment given .

## 4) Past History ( history of previous illnesses ) :

- History of similar condition or related illnesses.
- Previous infectious diseases.
- Past chronic or recurrent illnesses.
- Previous hospital admissions.
- Previous surgeries or accidents.
- Previous investigations or treatment .



## 5) Perinatal History :

a- Obstetric history of the mother:
- Mother's age at conception.
- Fertility status of the mother.
- Previous pregnancy, previous abortions.

b- Prenatal ( antenatal ) history :
- Drugs ,infections, irradiation during pregnancy.
- Maternal diseases in pregnancy ( e.g. diabetes or hypertension ).
- Toxemia of pregnancy .

c- Natal history:
- Time of delivery ( at term , or premature).
- Nature of delivery ( normal or abnormal)
- Intrapartum medications .
- Intrapartum complications.

d- Post natal history :
- Birth weight.
- Condition of the infant at birth ( need for resuscitation).
- Incubator care .
- Neonatal problems as jaundice , respiratory distress , cyanosis , convulsions .

## 6) Nutritional ( feeding ) History :

- Type of feeding ( breast or bottle).
- Details of breast feeding ( to assess adequacy):
  Positioning and attachment ( i.e.technique of breast feeding) , number of feeds .
- If bottle feeding : why , number of feeds/day , how to prepare each meal ( type of milk , number of measures ,and amount of water /meal ).
- Weaning : time of onset , food given and amounts.
- Any problems of feeding as refusal , regurgitation.etc.
- Vitamin supplementation.

## 7) Developmental History :

- Details of developmental milestones in the 4 fields ( gross motor , fine motor , language and personal-social) to detect any developmental delay in each field.

*Revise the developmental milestones.*

## 8) Vaccination History :

- Ask about the vaccines given.
- Review the vaccination record if available.
- Ask about side effects or complications of vaccines .

*Revise the vaccination schedule.*

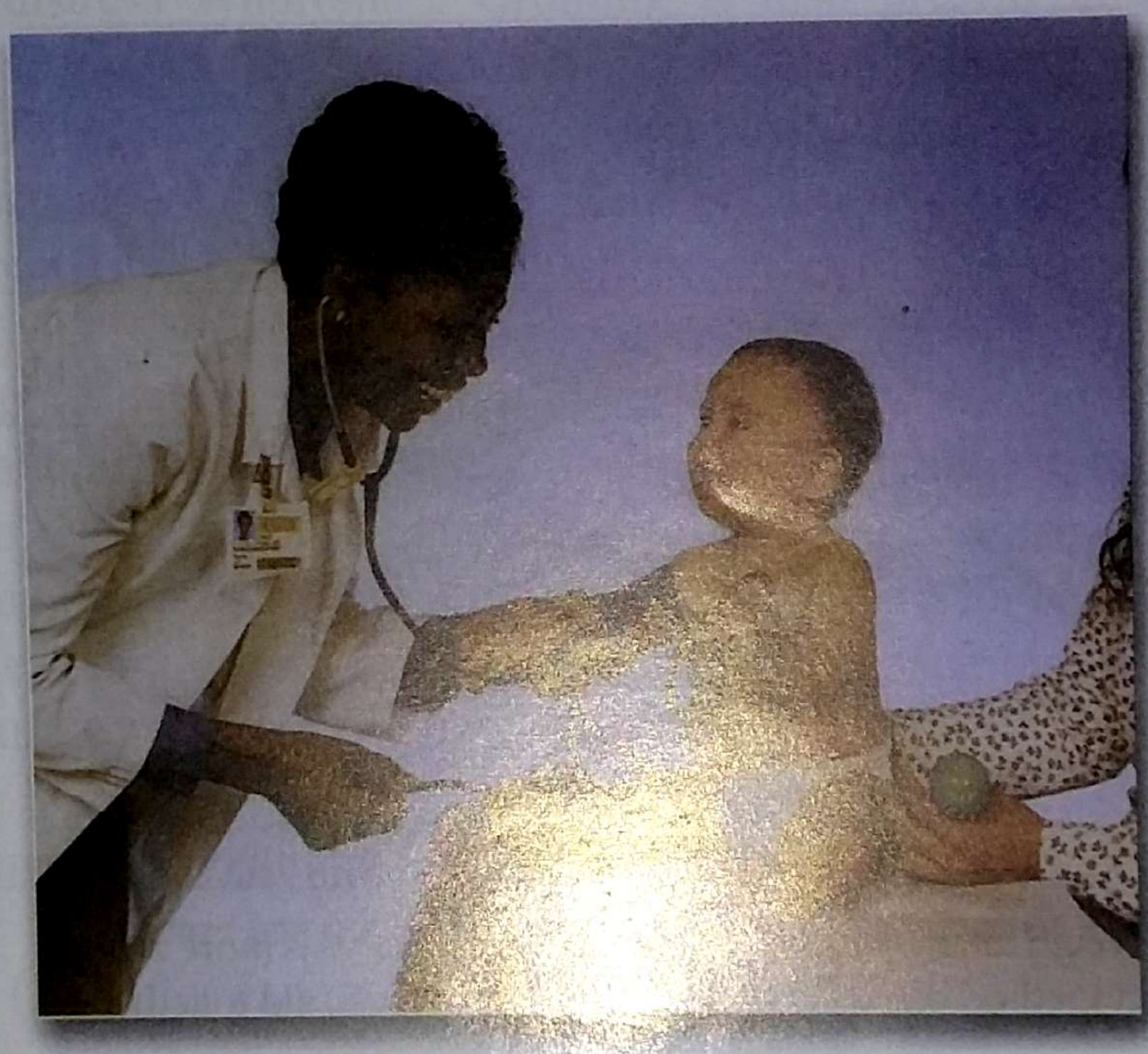
## 9) Family History :

- Parents : age , condition of their health , consanguinity, occupation and social condition.
- Siblings : age , sex , condition of health. Any similar illness should be recorded.
- Significant events as abortion, stillbirths, previous deaths , allergy, rheumatic fever, diabetes , tuberculosis or any other illness in the family as chronic hemolytic anemias or hemophilias.

## 10) Other Items may be needed in History

- Psychological / Behaviour history.
- School performance .
- Special habits.

# General Examination



# General Examination :

## 1- General look :

1 - Does the child look well or ill.
2 - Alert or not.
3 - Irritable or calm.
4 - Interested in the surroundings or not ( toys presented by the physician).
5 - Able to drink or breast feed.
6 - Does he vomit everything.
7 - Pale or cyanosed.
8 - Does he look malnourished.
9 - Any respiratory distress ( grunting , acting alae nasi).

Grunting is a sign of loss of lung volume. It is heard in neonates with respiratory distress syndrome . Grunting is also present in infants with pulmonary edema and in pneumonia. By grunting , the infant closes the glottis at the start of expiration to build up a positive end expiratory pressure which protects alveoli from collapse . This is followed by rapid expulsion of air against partially opened glottis which produces the sound of grunting.

Acting alae nasi : is a sign of increased airway resistance . The infant prefers nasal breathing ( so called obligatory nasal breather ). With breathing through the nose , 50% of the resistance to airflow occurs in the nose , whereas the other 50% occurs in the large airways . With obstruction in the airways, the infant can decrease total airway resistance by flaring the alae nasi and thus decreasing the resistance of the nose.

In inverted breathing a pause is present after inspiration which allows for grunting to occur. Normally , the pause is present before inspiration ( i.e. after expiration)

## 2- Posture :

Abnormal postures as opisthotonus ( see CNS examination).

## 3-Vital signs :

**A-Pulse :**

Clinically, there are different areas to feel a pulse :

1- Radial pulse : Keep the child's forearm in slight pronation and wrist in mild flexion. Feel with the tips of 3 fingers of your hand , compressing the vessel against the bone of the radius. Radial pulse is difficult to be palpated in newborn and young infants

2- Brachial pulse : it is felt just medial to the tendons of biceps muscle in the lower part of the arm. It can be palpated in newborn and young infants.

3- Carotid pulse : the carotid artery may be gently compressed against the transverse processes of the cervical vertebrae. Care should be taken not to palpate both carotids simultaneously ( danger of critically reducing the cerebral arterial supply). It can be palpated in children .

**4- Femoral pulse : the femoral arteries lie midway between the anterior superior iliac spine and pubic tubercle . The pulse is easily palpated against femur. The patient should be supine with slight flexion, abduction and lateral rotation of the hip in the examined side . It can be palpated at any age.**

5- Popliteal pulse : they are routinely checked .They are examined with the patient's knees flexed at an angle of 120 degrees . The fingertips are placed in the popliteal fossa , with the thumbs resting on the child's patella.

6- Posterior tibial pulse : detected 1 cm behind the medial malleolus of the tibia.

7- Dorsalis pedis pulse : is felt over the dorsum of the foot by compressing over tarsal bones.

Once a pulse has been localized , observation about the following should be done :

| Peripheral pulse |
|---|
| Rate |
| Rhythm |
| Force |
| Volume |
| Special character |
| Equality on both sides |

i- Rate:

The apical pulse from the heart is measured in infants younger than 2 years of age because the radial pulse is difficult to locate. Also, apical pulse should be measured at any age when cardiac disease has been identified or when the radial pulse is irregular . Radial pulse could be palpated after the age of 2 years .

| Normal Pulse Rate | |
|---|---|
| Newborn | 100-170 beats /minute |
| < 1 y | 80- 160 beats /minute |
| 2 yrs | 80- 130 beats /minute |
| 4 yrs | 80- 120 beats /minute |
| 6 yrs | 75- 100 beats /minute |
| 8-10 yrs | 70- 90 beats/minute |
| Adolescent | 55- 90 beats/minute |

**Tachycardia** : increased pulse rate :

- physiological : exercise and crying
- Pathological : fever ( increased pulse rate by 10-15 beats/1◦c temperature rise) , heart failure , arrhythmia as paroxysmal supraventricular tachycardia ,hemorrhage and anemia, thyrotoxicosis and drugs as atropine , adrenaline and aminophylline.

**Bradycardia** : ( decreased pulse rate )

- in myxedema , heart block, or excess digitalis and increased intracranial pressure.
- Pulse deficit means apical pulse is more than radial pulse : in atrial fibrillation ( the difference ≥ 10 beats /minute ).

ii- Rhythm : Normal heart has a regular rhythm.

In respiratory sinus arrhythmia ( a normal finding ) : the heart rate increases during inspiration and decreases during expiration. In inspiration , the venous return is increased→ Tachycardia.

| Arrhythmia | |
|---|---|
| 1-Irregular irregularity | : as in Atrial fibrillation |
| 2-Regular irregularity | : as in extra-systoles ( premature beats) |

iii. Force : external pressure needed to occlude the blood flow completely . It is assessed from systolic BP. Description is : Normal , Increased or Decreased.

iv. Volume : The amount of elevation of the palpating finger at arrival of each pulse wave . It is assessed from pulse pressure ( i.e. difference between systolic and diastolic BP ). Description is : Normal , Increased or Decreased ) .

v. Special character :

## 1-Water hammer pulse (Collapsing or Corrigan's pulse ):

- Forceful , jerky beat caused by wide variation in pulse pressure. Rapid rise of pulse wave occurs followed by rapid fall with decrease in diastolic pressure.

- It is detected by holding the child's wrist and feel the radial pulse with the palm at finger bases. Then lift the hand upwards quickly , In the normal, the pulse becomes weaker. While in collapsing pulse , it is felt to slow initially followed by an increased intensity . It is present in aortic regurgitation , PDA or peripheral arterio-venous fistula .

- The mechanism of the high volume collapsing pulse is as follows: In conditions as AR , PDA there is increased stroke volume which leads to abrupt rise in the pulse wave. The rapid fall of the diastolic BP is due to 2 factors :a rapid run-off of blood into the left ventricle or ductus arteriosus and rapid run –off to the periphery because of low systemic vascular resistance .

## 2-Bounding pulse :

Normal pulse with increased volume ( but diastolic BP is normal).

- It is present in hyperkinetic states ( as fever, anemia or thyrotoxicosis ).

## 3-Thready pulse :

Weak rapid pulse. The pulse is difficult to palpate , seems to appear and disappear , It occurs in shock.

4- Pulsus alternans :

One beat is strong and the next is weak , is a sign of severe heart strain ( as in serious myocardial disease ) the strong beat is due to contraction of diseased and healthy muscle fibers while the weak beat is due to contraction of the healthy muscle fibers only.

5- Pulsus paradoxicus :

Normally , the systolic BP decreases about 10 mm Hg during inspiration ( because the increased capacity of the lung by inspiration decreases the amount of blood returning to the left atrium and left ventricle → decreases systolic BP).

In pulsus paradoxicus ( which is a misleading name) , the decrease in systolic BP is more than 10 mmHg i.e. exaggeration of what is normal.
It occurs in severe attack of bronchial asthma and in cardiac tamponade ( caused by pericardial effusion , or constrictive pericarditis ) It needs measuring the systolic BP during inspiration and during expiration.

6- Slow rising pulse : there is slow upstroke with a delayed peak. The pulse in aortic stenosis is classically (parvus et tardus ) i.e. low volume and prolonged systolic peak .

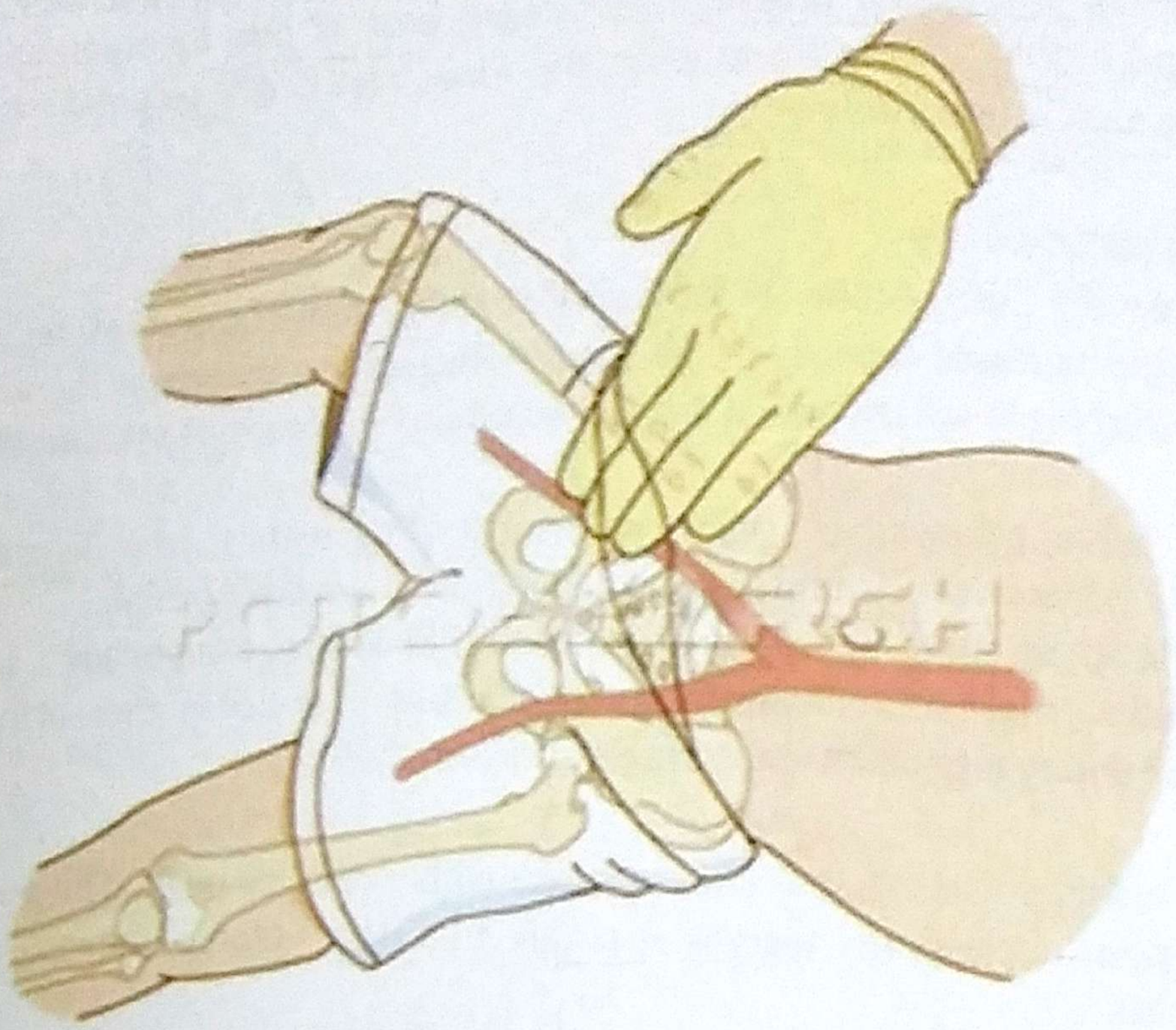
7- Pulsus bigeminus : A premature beat follows each normal beat → coupling of the pulse ( each 2 beats together are followed by a longer pause ).

8- Pulsus trigeminus : when a premature beat follows every 2 normal beats and a long pause separate each 3 beats.

vi.Pulsations on other arteries :

Femoral pulse and other pulses as dorsal pedal pulse should be palpated if cardiac defects are suspected :

| Diminution or absence of the femoral pulse occurs in coarctation of the aorta. |
|---|



*Palpation of the femoral pulse : note the position of the examined lower limb*

## B- Temperature :

*Guidelines :*

1- Select the site for temperature measurement based on the child's age and condition .

***Rectal :*** can be used in all age groups , but is used particularly in infants in the first 2 years.

***Axilla*** : can be used in all age groups, particularly preschool children.

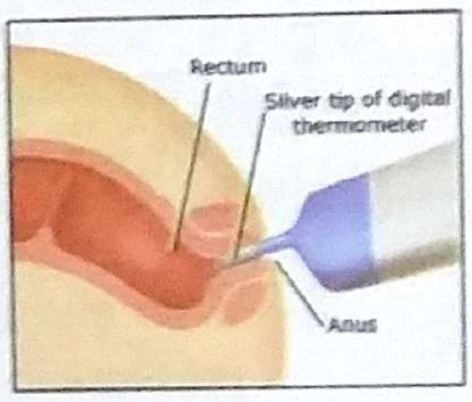
***Oral*** : used in cooperative schools aged children and adolescents . It is not used if the child is comatosed or seizure prone or on Oxygen therapy.

2- Position the child appropriately :

- for axillary temperature , the child is held quietly in mother's lap. The thermometer is put in the axilla for at least 3 minutes.
- For oral temperature, have the child sit or lie quietly. The thermometer is put for 2 minutes.
- For rectal temperature, the infant lies on his side with knees flexed towards the abdomen OR

<u>as illustrated below</u> , *the infant is placed in prone position , the buttocks are separated with the thumb and index finger of one hand and the well lubricated rectal thermometer is gently inserted by the other hand.*

The thermometer is inserted about 2 cm and held by the parent or physician as long as it is in place ( for 2 minutes) . Never take rectal temperature with the child lying in supine position. This increases the chance of breaking the thermometer or perforating the rectum.




| Normal temperature : | Abnormal temperature |
|---|---|
| Oral = 36.6 – 37.2◦ C<br>Rectal = Oral – 0.5 ◦ C<br>Axillary = Oral + 0.5 ◦ C | Hypothermia = < 35 ◦ C<br>Subnormal = < 36.6 ◦ C<br>Febrile > 37.2 ◦ C<br>Hyperpyrexia > 41.6 ◦ C |

## C.Blood pressure :

*Guidelines:*

1- The proper cuff size = 1/2 – 2/3 the length of the arm.
Large cuff → too low reading.
Small cuff → too high reading.

2- Check the apparatus before starting. Check the mercury column ( it should be at zero ) Check the bulb and pressure valve.

3- The child should be sitting or lying at ease . The manometer is placed so as to be at the same level as the cuff on the arm and the observer's eye.

4- The cuff is applied to the right arm , with the lower border not less than 2.5 cm from the cubital fossa .

5- Record systolic and diastolic pressures at the appearance and disappearance of Korotkoff's sounds.

6- Expose the limb completely , compression of the limb by rolled up clothes produces a tight band which gives false low reading. If the child is upset by removal of clothes , it is best to apply the cuff over the sleeve rather than rolling it up.

7- In measuring BP in lower limbs, the child is positioned on the abdomen.

8- If an elevated BP is recorded , the measurement should be repeated and the pressure is measured in the other 3 extremities.
9- In any patient suspected of having heart disease , the blood pressure is measured in the four extremities ( or at least the 2 upper limbs and one L.L.)

## *Methods of BP measurements:*

1- Palpatory method :

Palpate the arterial pulse while the mercury in the manometer is allowed to fall . Note the point where there is return of pulsation. This gives the systolic blood pressure.

2- Auscultatory method :

-Palpate the brachial artery if using the arm, or the popliteal artery if using the thigh. Inflate the cuff to 30 mm Hg above the point at which pulse disappears .

- Place the stethoscope lightly over the brachial artery .
- Gradually release the valve to reduce pressure at a rate of 2-3 mmHg/second.

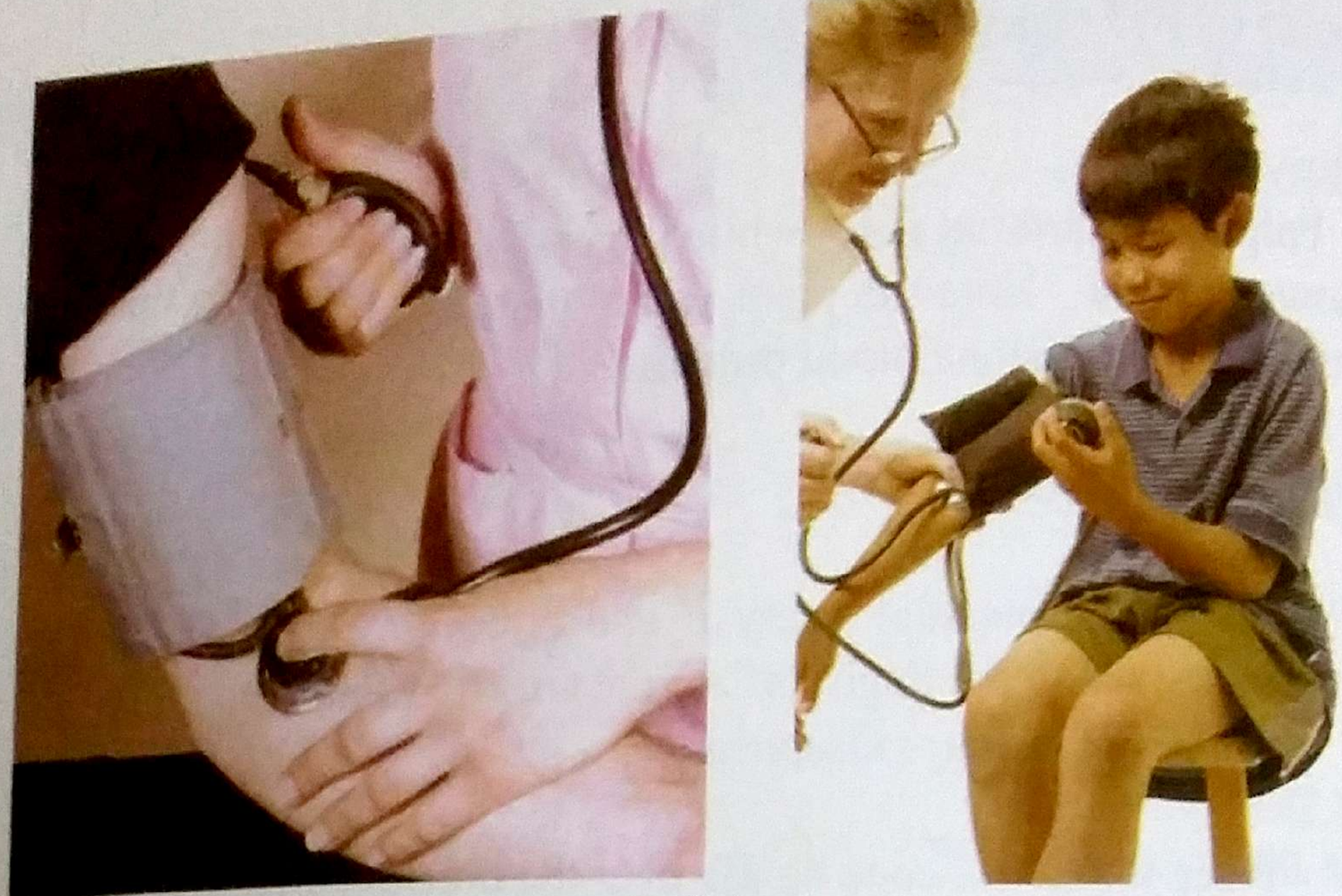
- Listen carefully for the first sound, which indicates the systolic pressure . As you continue to lower the pressure , the sounds suddenly become faint and then disappear ( diastolic pressure).

- Deflate the cuff rapidly once readings have been obtained wait 30 seconds before obtaining further readings.

- Normally the lower limb pressure is higher by 10-30 mmHg in both systolic and diastolic pressures. This is due to the relatively smaller cuff size ( trying to occlude the greater muscle bulk of the thigh ). In coarctation of aorta, the recorded pressure in the lower limb is lower , and in aortic regurgitation it is higher by 40 mmHg ( Hill's sign).

- The systolic pressure obtained by palpatory method is about 10 mm Hg lower than the true systolic pressure.

- In neonates and young infants , The BP can be measured by the Doppler apparatus.



*Measurement of blood pressure*

| Normal value of blood pressure: | |
|---|---|
| At birth =85/50 mmHg | 10 year =110/60 mmHg |
| 6 months = 90/60 mmHg | 12 years =115/60 |
| 6 years = 100 /60 mm Hg | 16 years = 120/65 mmHg |

As a rough guide , BP in normal children :
Mean systolic = 90 + age in years
Mean diastolic = 55 + age in years.

**Important causes of hypertension include :**

**Renal :**
- Acute and chronic glomerulonephritis
- Pyelonephritis.
- renal artery stenosis.
- Hemolytic uremic syndrome.
- Renal tumors.

**Endocrinal :**
- Cushing syndrome.
- Hyperthyroidism.
- Pheochromocytoma.

**Drugs :** as corticosteroids

**Vascular :**
- Coarctation of aorta.
- Polyarteritis nodosa.

**Idiopathic**

## D: Respiratory Rate :

*Guidelines:*

- Obtain respiratory rate by watching , palpating or auscultating the chest.
- The infant or child should be calm , count respiration for 1 full minute since respiration of infants and young children can be quite irregular.
-While counting , note the depth and rhythm of breathing.
-Normally the breathing is mainly abdominal till the age of 7 years.

| Normal respiratory rate: | |
|---|---|
| At birth | 40-80 breath /minute |
| 1-6 months | 30-40 breaths/minute |
| 6 month – 2 years | 20-30 breaths/minute |
| School children | 20-25 breaths/minute |
| At puberty | 15-20 breaths/minute. |

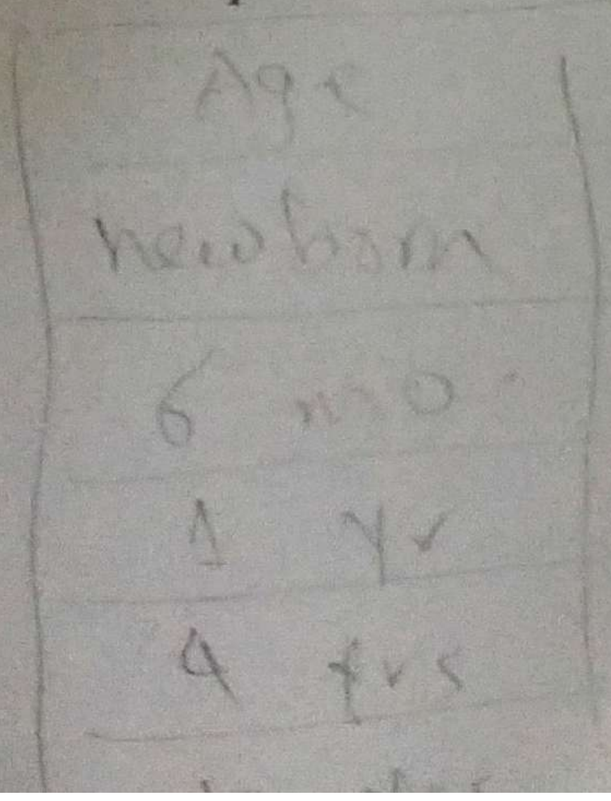
*Notes :*

1-The respiratory rate decreases with age .

2-Tachypnea ( increased respiratory rate ) is considered if the respiratory rate =

| | |
|---|---|
| Birth - <2 months | > 60 cycles /minute |
| 2m - <1 year | > 50/cycles /minute |
| 1year- 5 years | > 40 cycles /minute |

3- Tachypnea occurs with anxiety, crying , fever, and diseases as pneumonia, asthma or heart failure.
4- Bradypnea ( slow RR ) occurs in overdosage of narcotics.
5- Periodic breathing : is normal in the newborn .The rhythm is irregular with apnoeic spells ( usually less than 15 seconds ). Apnoeic spells > 20 seconds are considered pathologic).



## 6- Abnormal respiratory patterns :

### a- Cheyne-Stokes breathing :

There is a gradual deepening and decreasing of RR and effort followed by a period of apnea. It is seen in severe cardiac failure , narcotic overdose , and brain damage at the level of both cerebral hemispheres

### b- Kussmaul breathing :

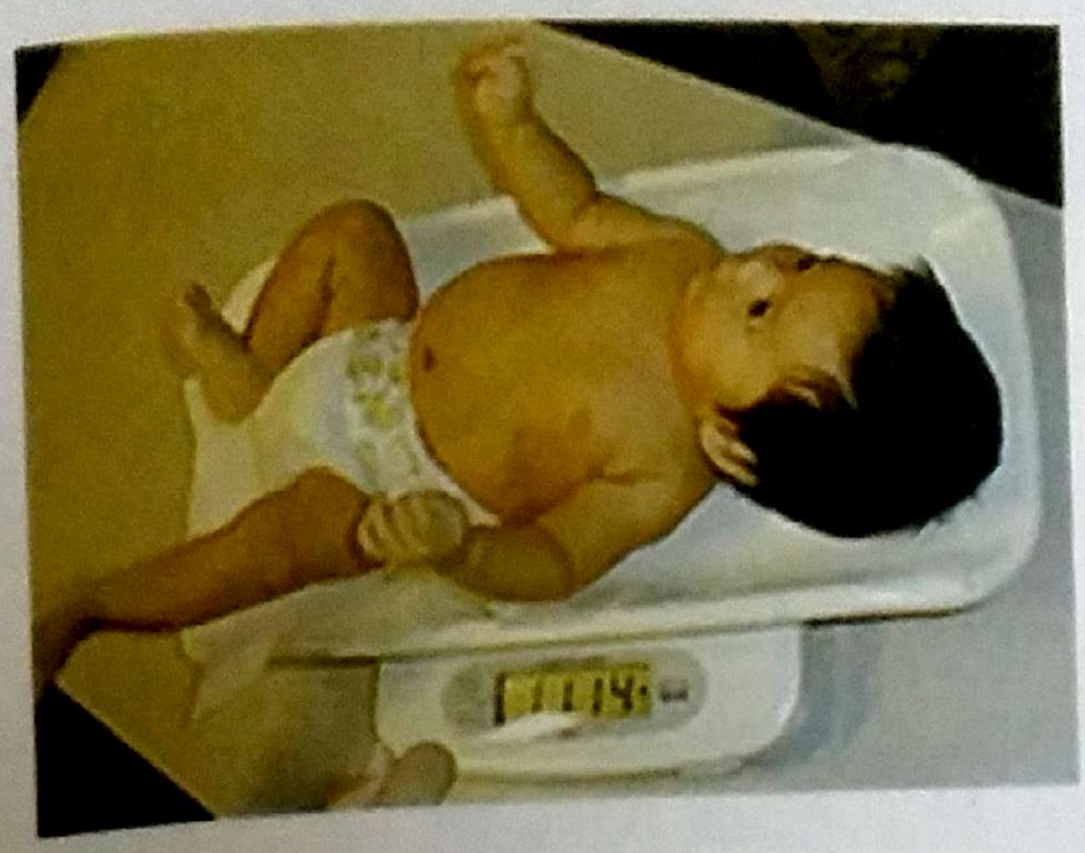
Rapid deep breathing , usually present in metabolic acidosis . Rapid deep breathing may be seen in exercise and anxiety.

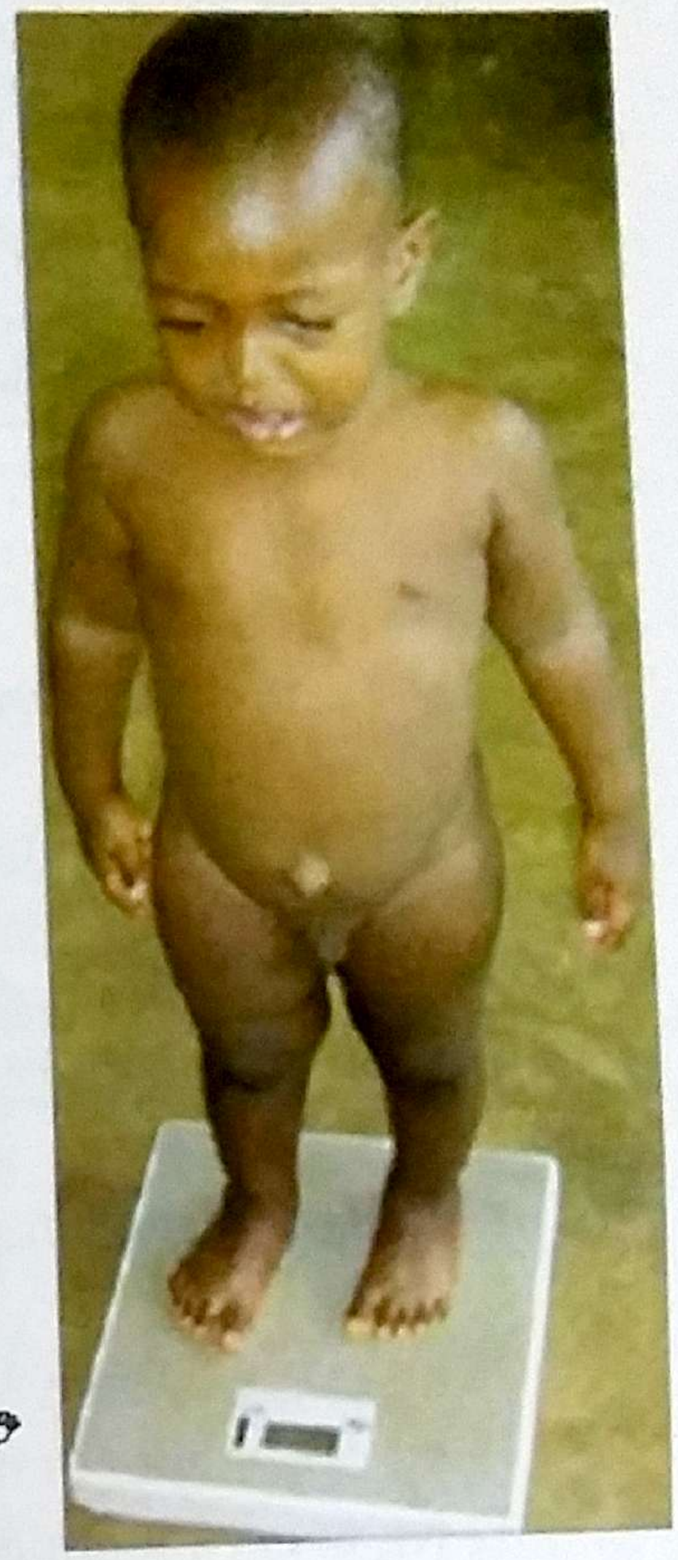
**C- Rapid shallow breathing :** in pneumonia , pleuritic chest pain and elevated diaphragm.

**D-Prolonged expiratory phase :** obstructive respiratory problems as asthma.

## 4) Anthropometric measurement :

### A- Weight :





*Different Scales for Weight*

i-Infants up to 2 years are weighed completely undressed using a balanced infant scale

ii-2-5 years old children are weighed on a standing scale undressed except for underpants.

iii- 5 years and older children are weighed on a standing scale ,Clothed with removal of shoes.

iv-The weight should be plotted on growth chart.

*Weight loss or failure to gain weight :* Dehydration , acute infections , feeding disorders , malabsorption ,chronic diseases and emotional difficulties.

*Rapid weight gain :* over hydration , overfeeding ,edema
Obesity : in overfeeding , endocrinal disorders( as hypothyroidism ) or intracranial disorders.

*Guidelines:*

1- The average weight at birth = 3-3.5 Kg..

2- There is an initial period of loss of weight in the first 3-4 days due to redistribution of body fluids with loss of extra –fluid in the extracellular fluid compartment .Most of the full term infants regain their birth weight by the age of 10 days.

3- Then, during the first year of life , the body weight increases as follows:

¾ kg every month in the first 4 months ( i.e. 3 Kg in 4 months).
½ kg every month in the second 4 months ( i.e. 2 Kg in 4 months).
¼ Kg every month in the third 4 months ( i.e. 1 Kg in 4 months ).

After the first year , the average weight of child can be calculated by the following formula :

Between 3-12 months :

$$\text{Weight in kg} = \frac{(\text{age in months}) + 9}{2}$$

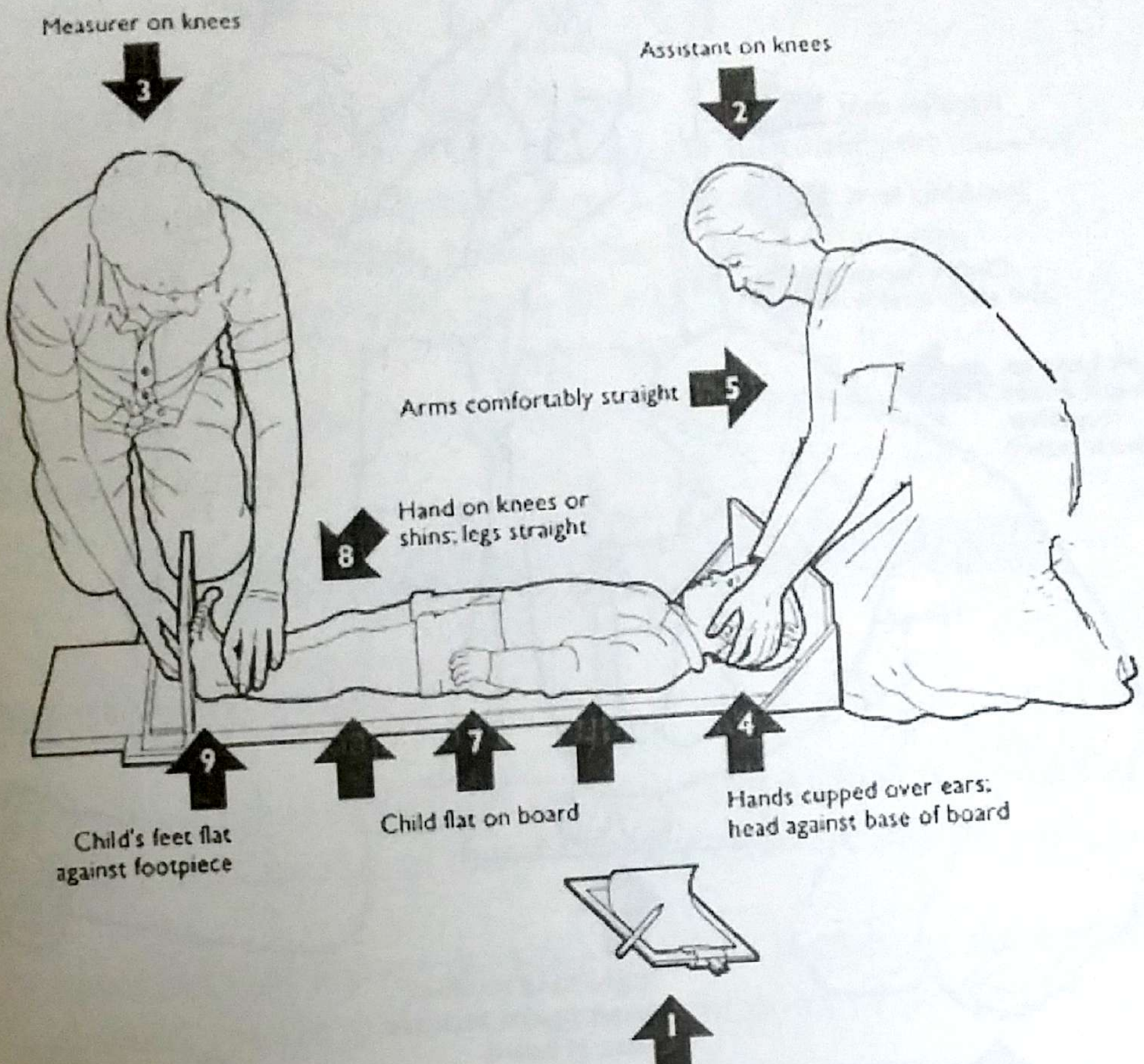
Between 1-6 years : 2 Kg/year

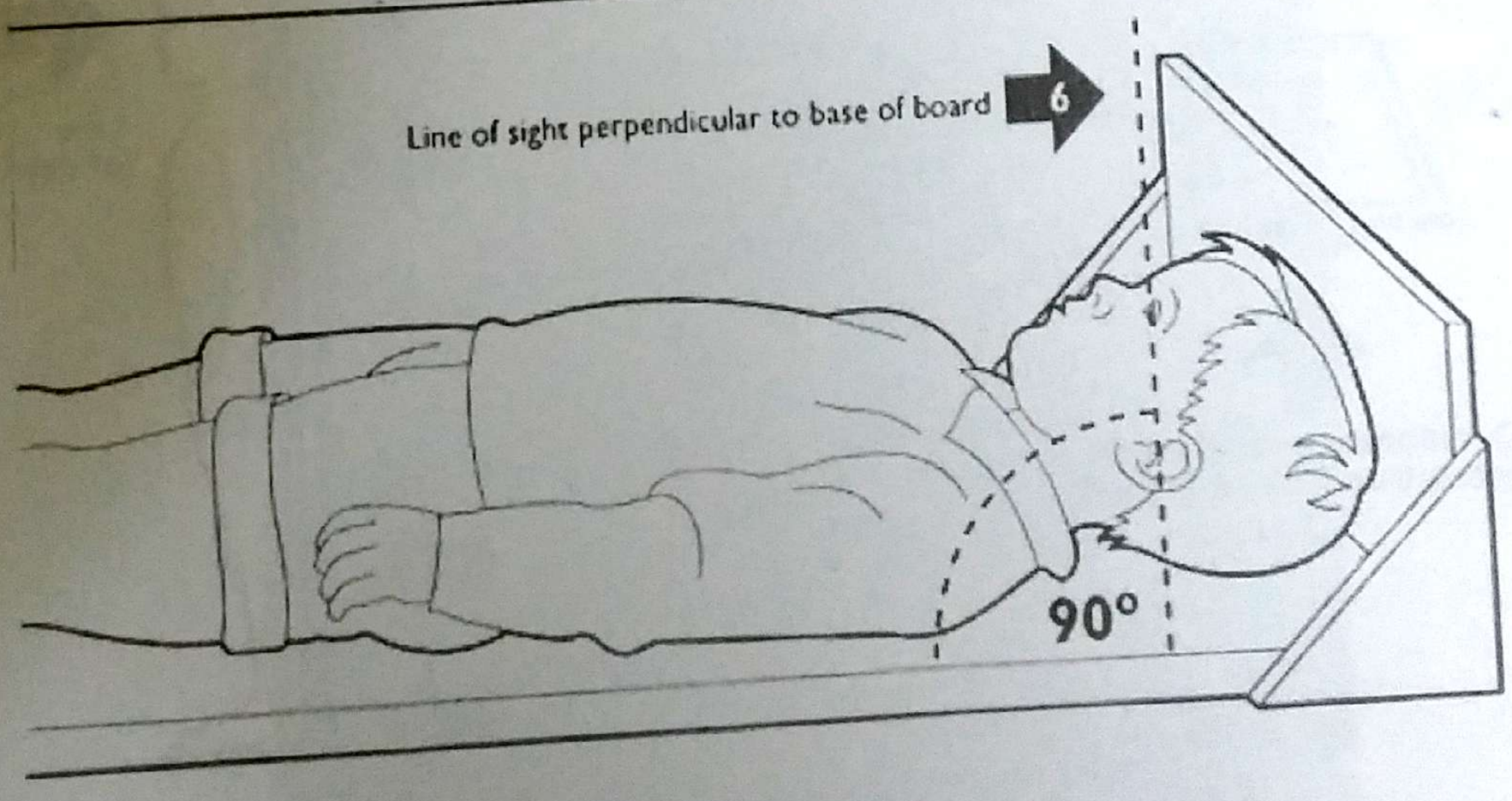
$$\text{Weight in kg} = (\text{age in years} \times 2) + 8$$

Between 7-12 years : 2.5 kg/y

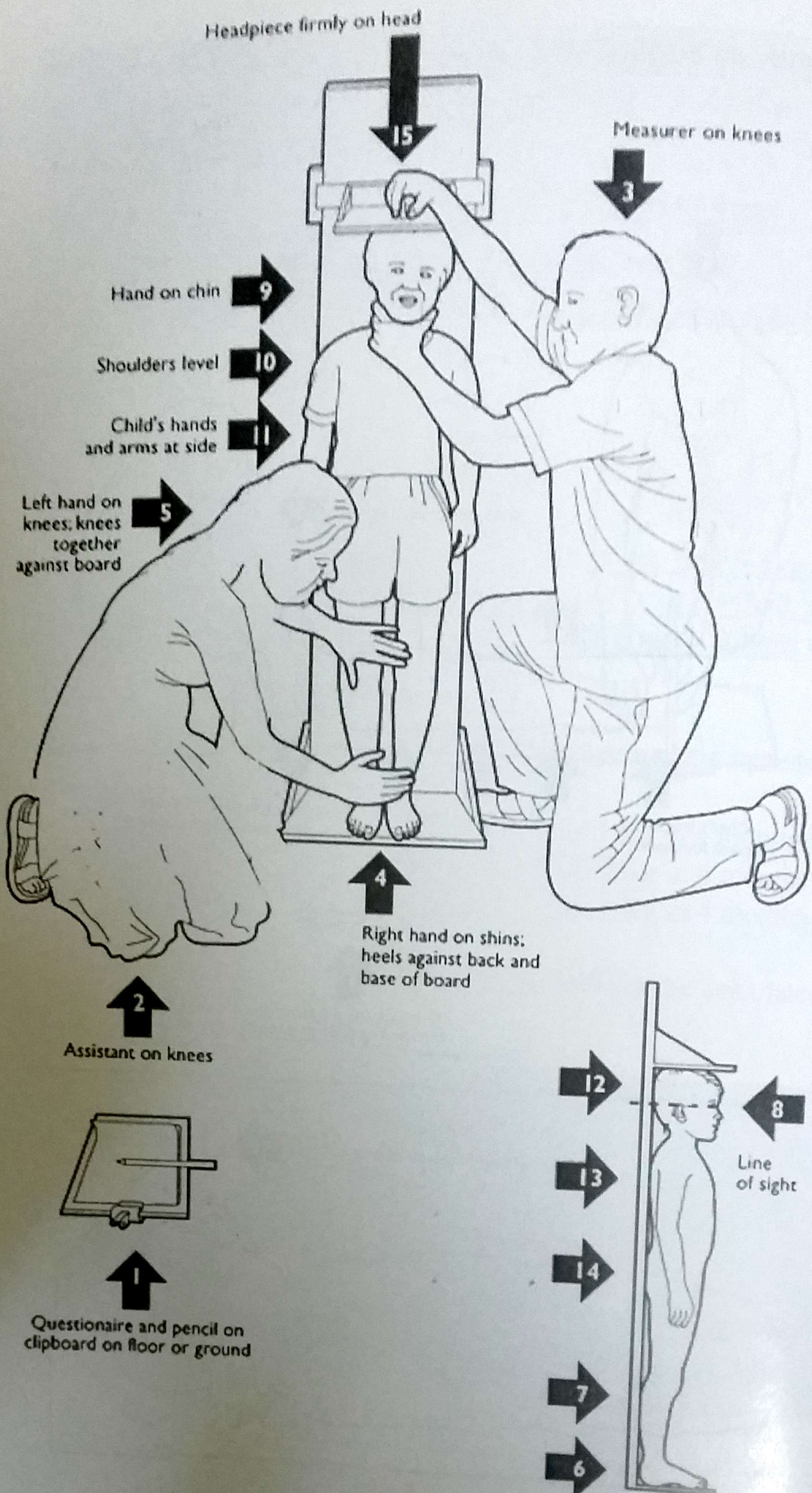
$$\text{Weight in kg} = \frac{(\text{Age in years} \times 7) - 5}{2}$$

## B: Length ( or height):




Measuring Length ( in recumbent position)




Measuring height ( in standing position)

*Guidelines:*

1- A good measure of the overall growth.
2-Measure the infant supine (length) while children who can cooperate ( usually > 2years ) are measured in standing position ( height ) on the scale.

3- The average length at birth =50 cm
4- During the first year of life , the length increases as follows
3 cm every month in the first 3 months.
2 cm every month between the 3rd and 6th month.
1.5 cm every month from 6th - 12th months of age.

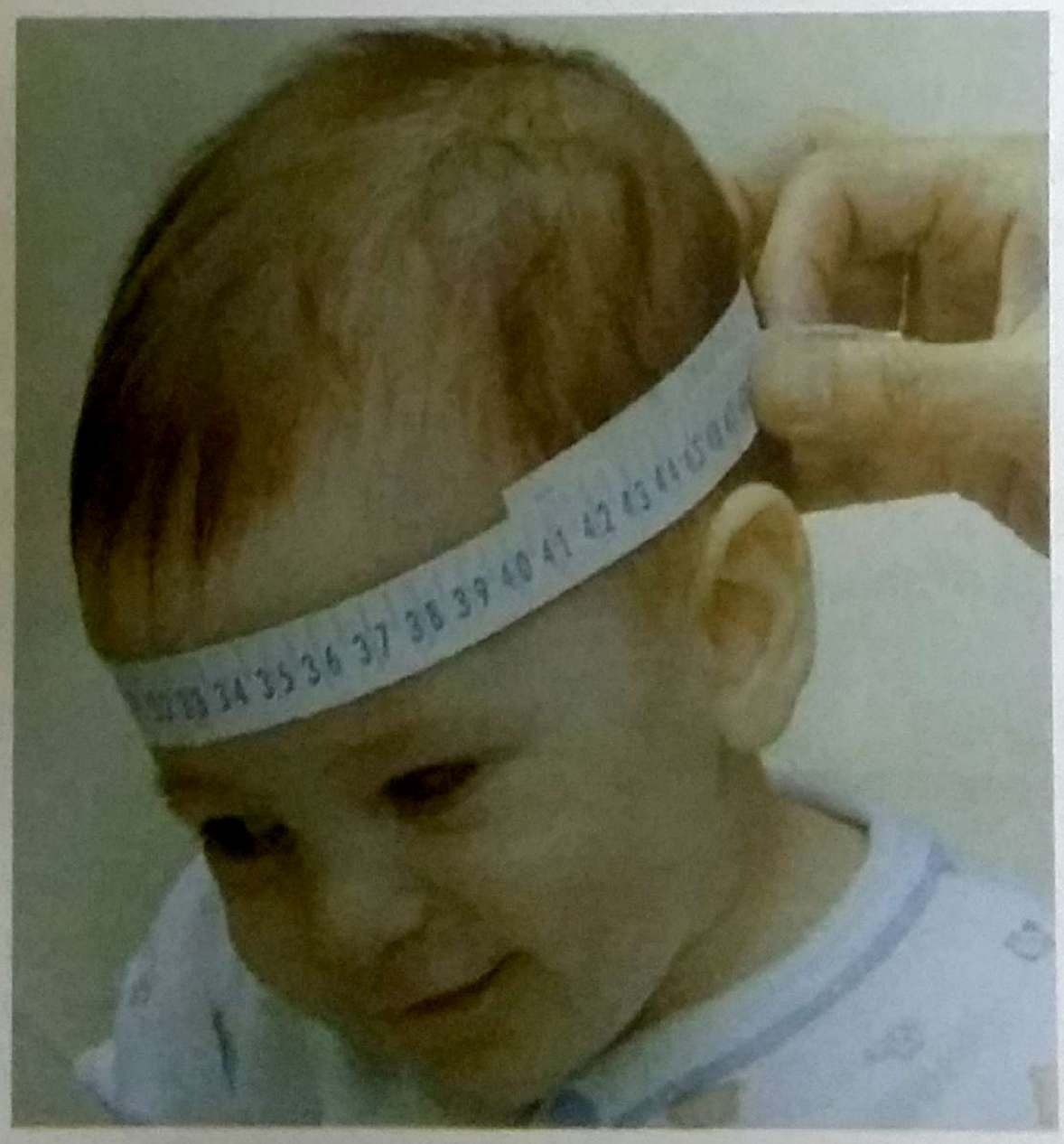
5-After the first year of life , the average length is calculated by the following formula :

| Age in years x 5 in years + 8 = length in cm |
|---|

## C: Head circumference :

1-The head circumference is measured if the child is 2 years of age or younger or if the size of child's head warrants concern.

2-Place the tape around the head at points just above the eye brows and above the ear to the most prominent point of occiput.



Measuring the head circumference

| Average head circumference ( cm) | | | |
|---|---|---|---|
| Birth | 35 | 3 years | 49 |
| 3 months | 40 | 5 years | 50 |
| 6 months | 43 | 7 years | 52 |
| 1 year | 45 | adult | 55 |

Small head : familial
Microcephaly
Craniosynostosis

Large head :
Hydrocephalus
Chronic hemolytic anemia
Rickets
Achondroplasia
Familial

## D: Other measurements:

### 1- Chest circumference :

It is measured in mid inspiration at the level of xiphoid. It is usually related to the head.

At birth , the head is larger by 2 cm then head circumference =chest circumference until the child is approximately 2 years old . After 2 years the chest is larger than the head .The relation is disturbed in large or small head

### 2- Upper/lower segment measurement : it is useful in assessment of short stature.

Upper segment = length from vertex to the symphysis pubis.
Lower segment = length from symphysis pubis to the feet .

| Normal U/L segment ration | |
|---|---|
| Birth = 1.7/1 | 3 years = 1.33/1 |
| 3 months =1.65/1 | 4 years =1.27/1 |
| 6 months = 1.61/1 | 5 years 1.21/1 |
| 9 months 1.58/1 | 7 years 1.14/1 |
| 1 year = 154/1 | 8 years =1.1/1 |
| 2 years =1.44/1 | 10 years 1/1 |

Persistently infantile ratio ( i.e infantile proportions) is seen in hyothyroidism and skeletal dysplasia e.g. achondroplasia .

*Achondroplasia ( short stature with infantile proportions) compared with normal child (left one) in the same age.*

3-Mid arm circumference : it is measured in the middle point between the acromion and olecranon. Normally, the lower limits of normal values for mid arm circumference are

Newborn = 9 cm
3 months = 10 cm
6 months = 11.5 cm
9 months = 12 cm
12months- 5 years = 13.5-14.5 cm

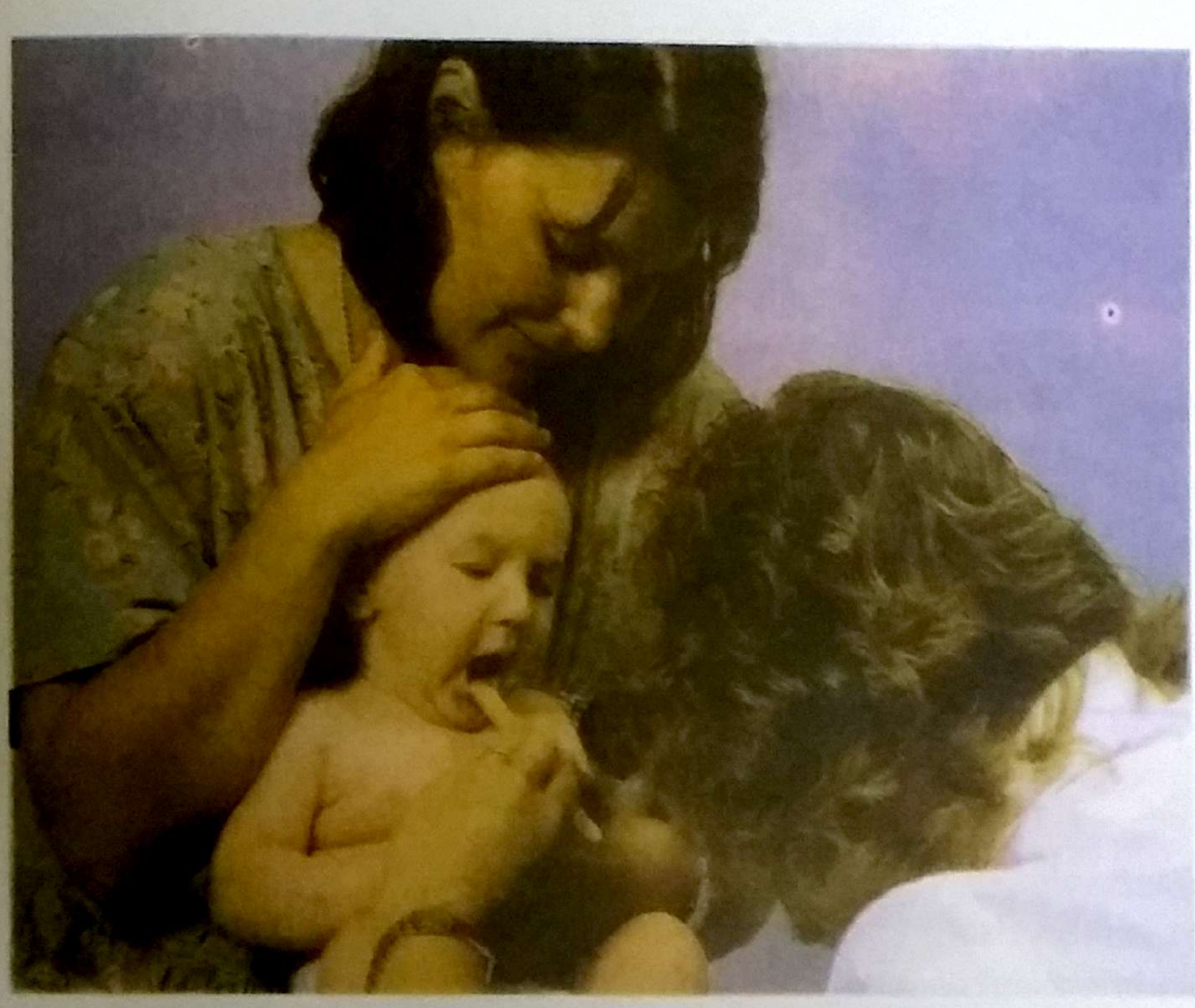
Values below these levels mean malnutrition.

## 4- Surface area of the body : in $M^2$

The surface area of the body could be measured using special nomogram. However it could be calculated using Mosteller formula for the surface area :

$$\textit{Body Surface Area} = \sqrt{\frac{\textit{Height (cm) X weight (Kg)}}{3600}}$$

# Head Examination



# Head Examination

## 1-Size of the Head:

### Small head :

Familial

Microcephaly : head circumference is more than 3 SD below the mean for age and sex of the child.

*Primary microcephaly ( note the narrow receding forehead)*

### Large Head:

Familial

Hydrocephalus

Subdural effusion or hematoma

Rickets

Chronic hemolytic anemia e.g. thalassemia major

Megalencephaly

Mucopolysaccharidosis

Achondroplasia

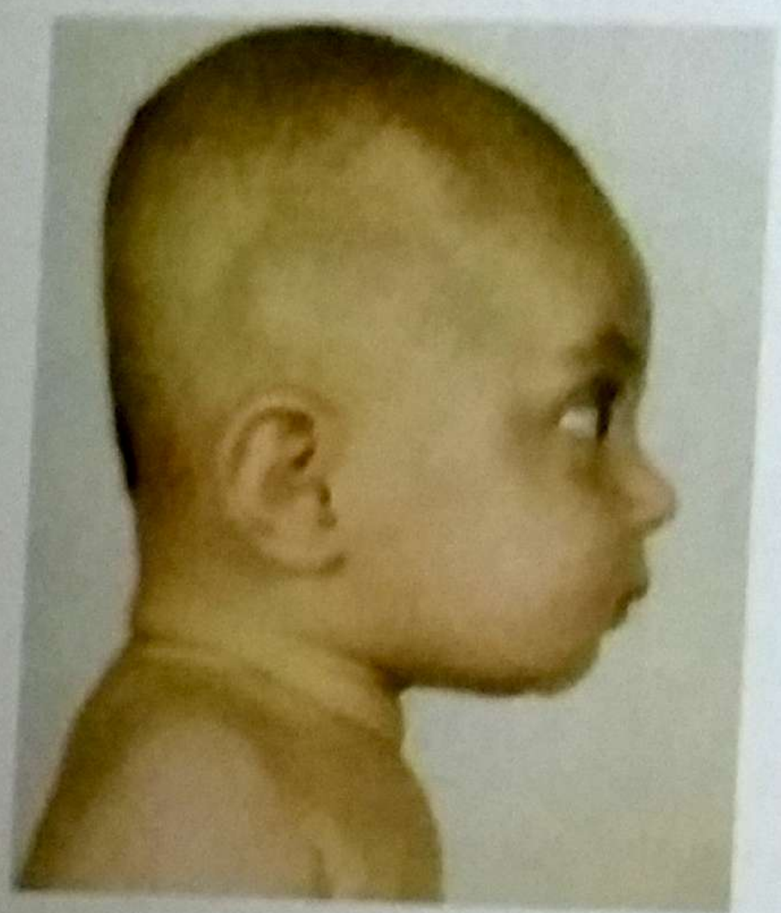
*Severe hydrocephalus*

## 2- Shape and Symmetry of the head :

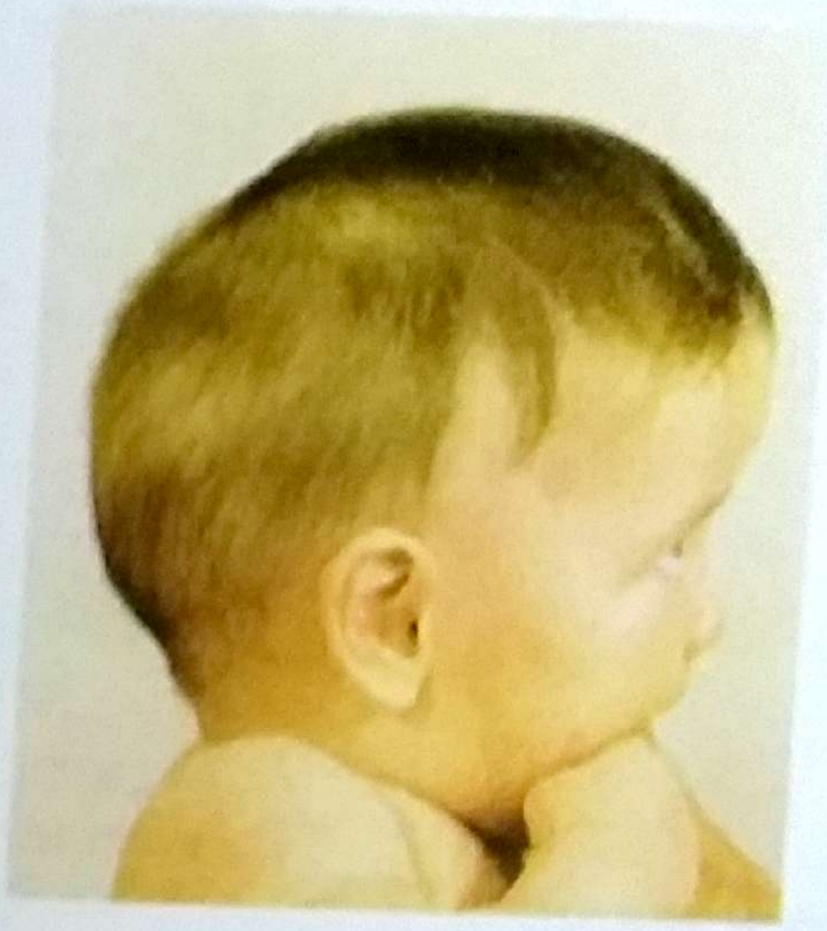
i- Minor asymmetry in infants younger than 4 months is common and is related to molding.

ii-A markedly flattened occiput may be the result of persistent placement of the child in the supine position ( *positional plagiocephaly).*

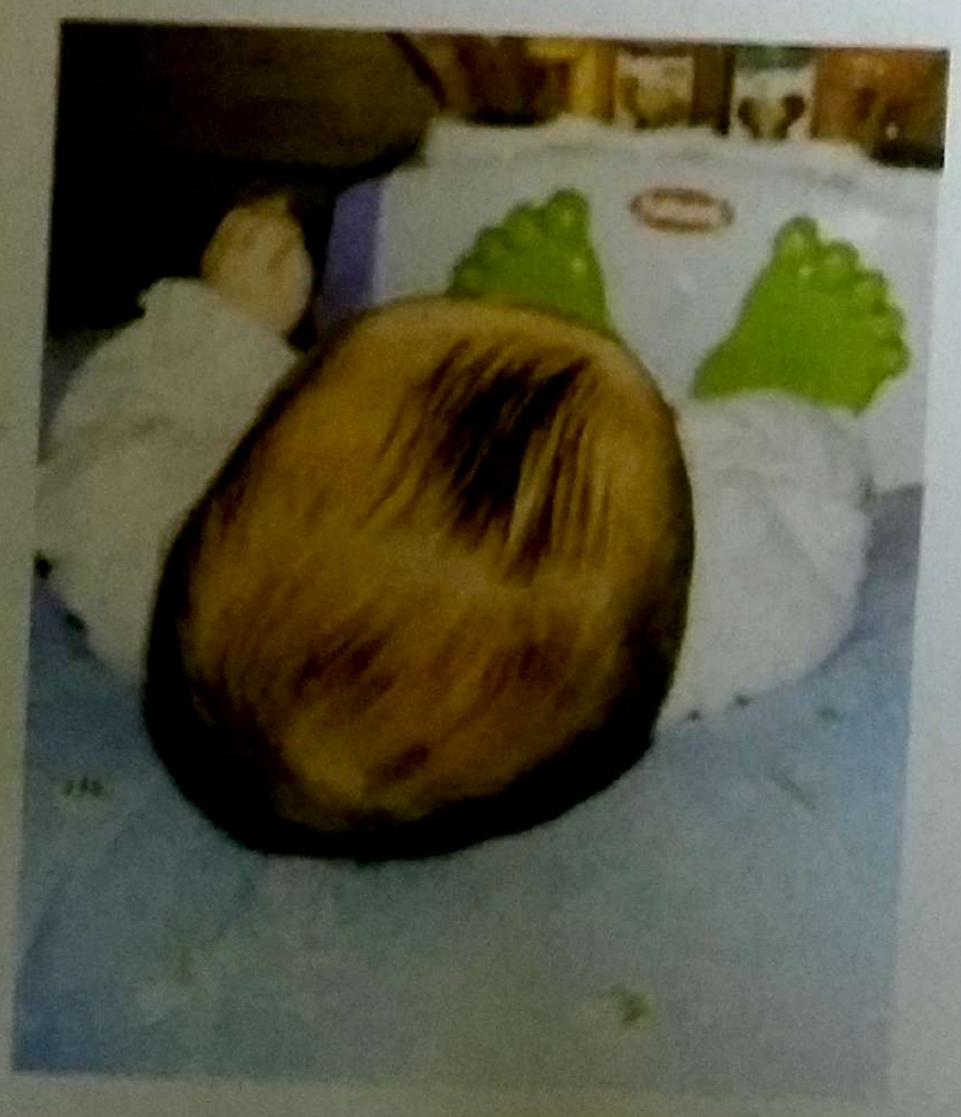
iii-Head asymmetry may be due to craniosynostosis. (see *scaphocephaly, brachycephaly , oxycephaly* )



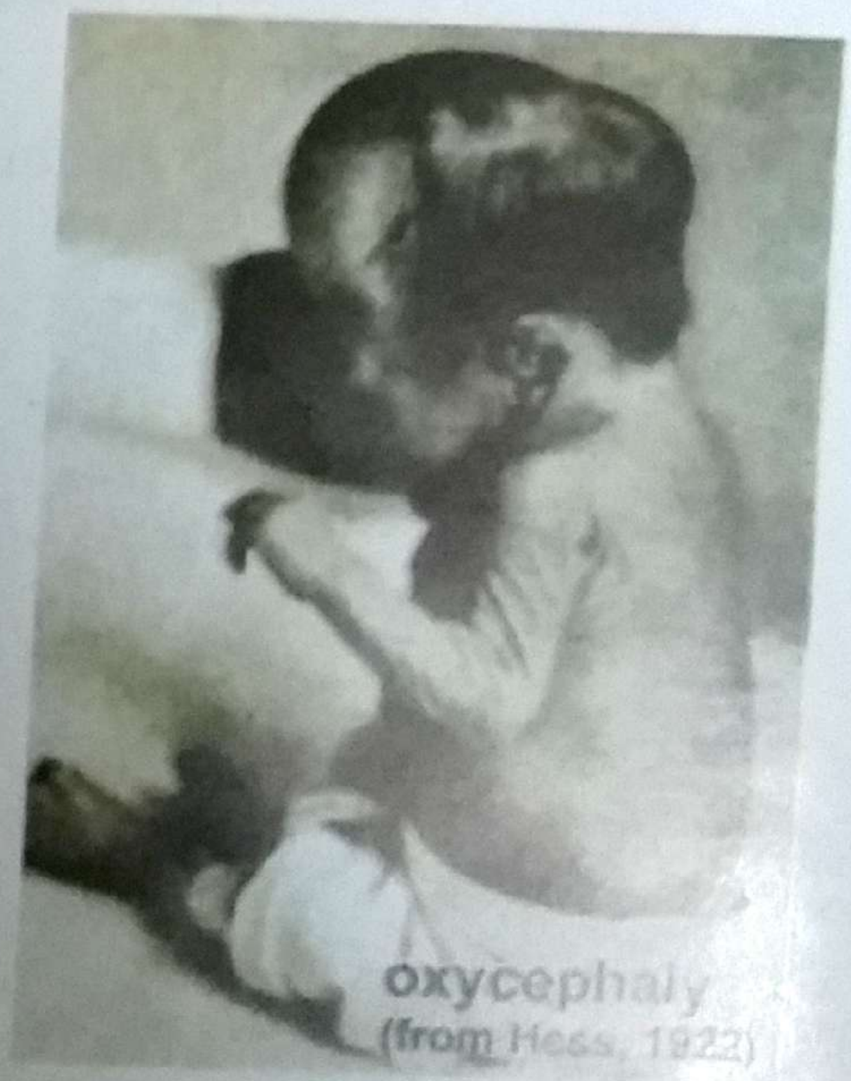
*Brachycephaly*



*Scaphocephaly*



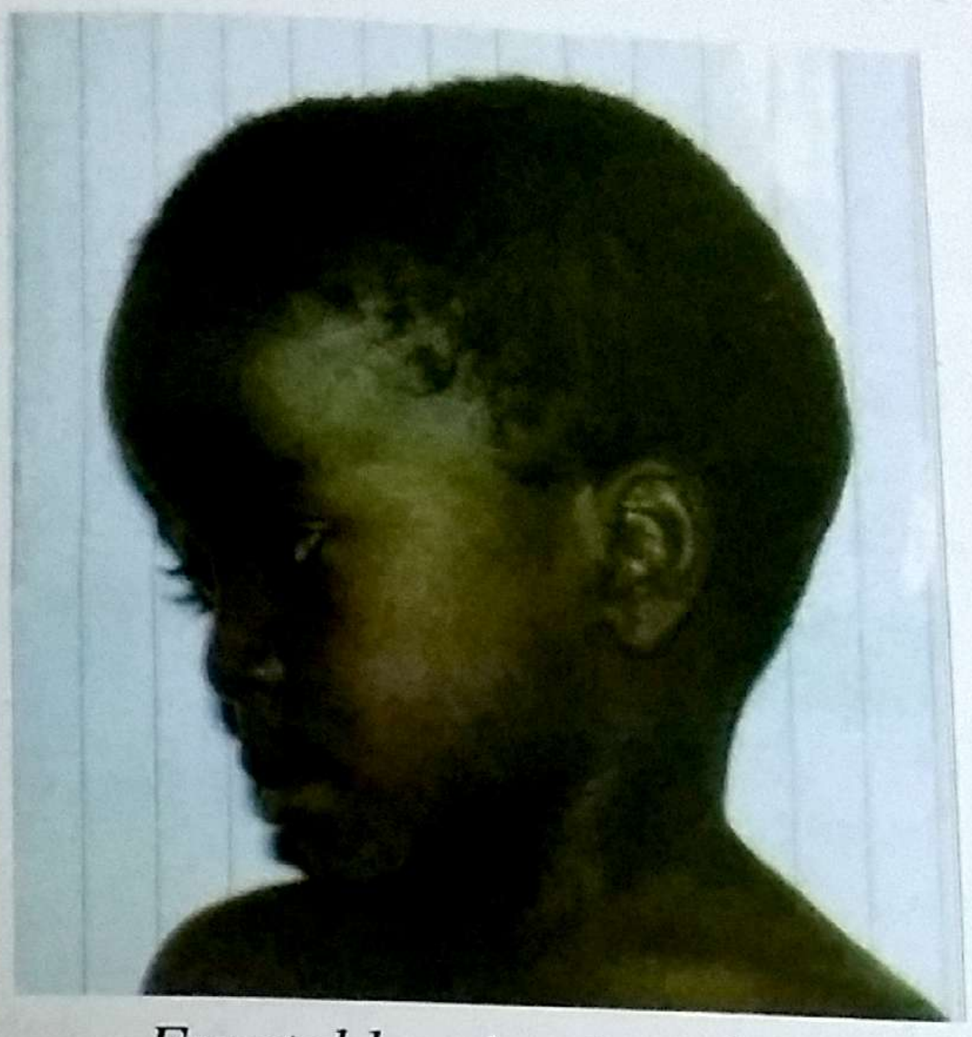
*Positional plagiocephaly ( note flattening of skull)*




*Oxycephaly ( note the raised anterior part of the skull )*

iv-Bossing : enlargement of frontal and parietal eminences of the skull. It may be seen in :

i. Rickets : bossing is due to presence of excess osteoid tissue at the frontal and parietal eminences which represent the site of new bone formation of the frontal and parietal bones .

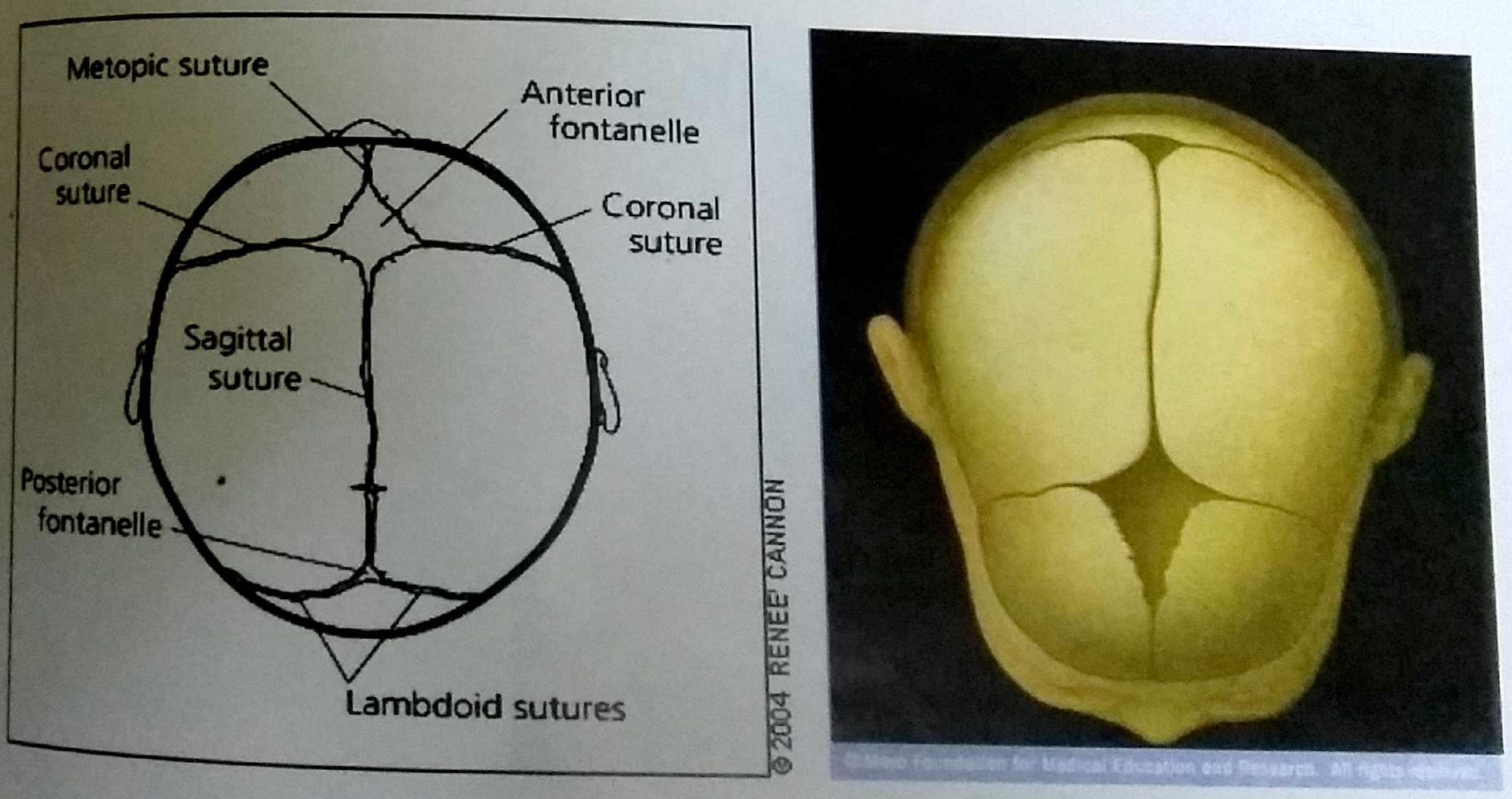


*Frontal bossing in rickets*

ii. Chronic hemolytic anemia e.g. thalassemia major. Bossing is due to expansion of the bone marrow space of the skull bones

## 3- Fontanels :

In infants , observe and palpate the fontanels while the infant is calm and sitting.




*Skull of infants from above , note the shape of fontanels*

## The anterior Fontanel :

-It is rhomboid in shape.
-It should be soft , flat and pulsatile. The pulsations are due to transmitted pulsations from the arteries of choroids plexus inside the ventricles of the brain . The fontanel bulges slightly when the infant is crying.

-*Date of closure* : The anterior fontanel normally closes at 6-24 months of age ( usually between 9-18 months ).

-Early Closure :

Microcephaly
Craniosynostosis

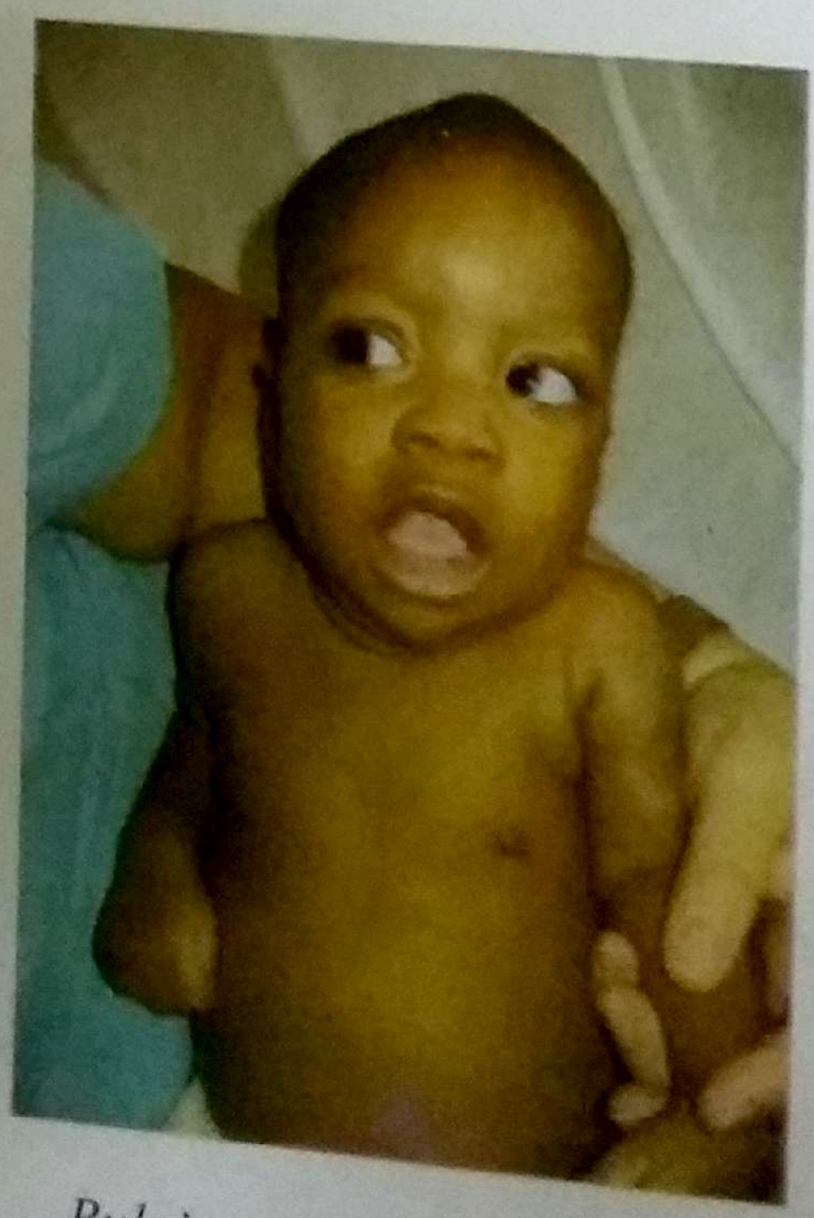
-Delayed closure :

Rickets
Hypothyroidism
Down Syndrome
Hydrocephalus
Osteogenesis imperfecta.

- *Measurements* : At birth , it is small in size due to molding , enlarges during the first 2 months and its measurement average 2.5 X 2.5 cm. After the age of 6 months it should decrease in size till closure.

- *Tension* :

a-Bulging anterior fontanel : which occurs due to



*Bulging anterior fontanelle*

a- Crying or straining.
b- Increases intracranial pressure : due to
- intracranial infection
- hydrocephalus
- neoplasms
- subdural effusion or hematoma

c- **Pseudotumor cerebri** ( benign increase in IC pressure):
may be due to :
- Rickets.
- Roseola infantum .
- Hypervitaminosis A .
- Tetracyclines .
- Rapid withdrawal of steroid therapy
- Hypoparathyroidism
- Addison disease.
- Lead poisoning.

Or- Idiopathic

b- Depressed anterior fontanel : occurs in
a- Dehydration e.g. in diarrhea
b- Malnutrition e.g. marasmus.

## The Posterior Fontanel :

The posterior fontanel may be closed at birth , and should always be closed by the second month .

Wide posterior fontanel ( > 0.5 cm in the horizontal diameter ) is one of the early manifestations of congenital hypothyroidism in the first month of life.

## 4- Sutures :

Palpate the suture lines in infants. In a newborn infant , the suture lines override as a result of molding. Sutures become flattened and ossify by 6 months.

- Widely separated sutures is present in increased intracranial pressure as Hydrocephalus.
- Ridge like sutures is present in craniosynostosis .

## 5- Craniotabes :

is the earliest bony change in rickets , it usually starts to be present from 3-6 months of age.

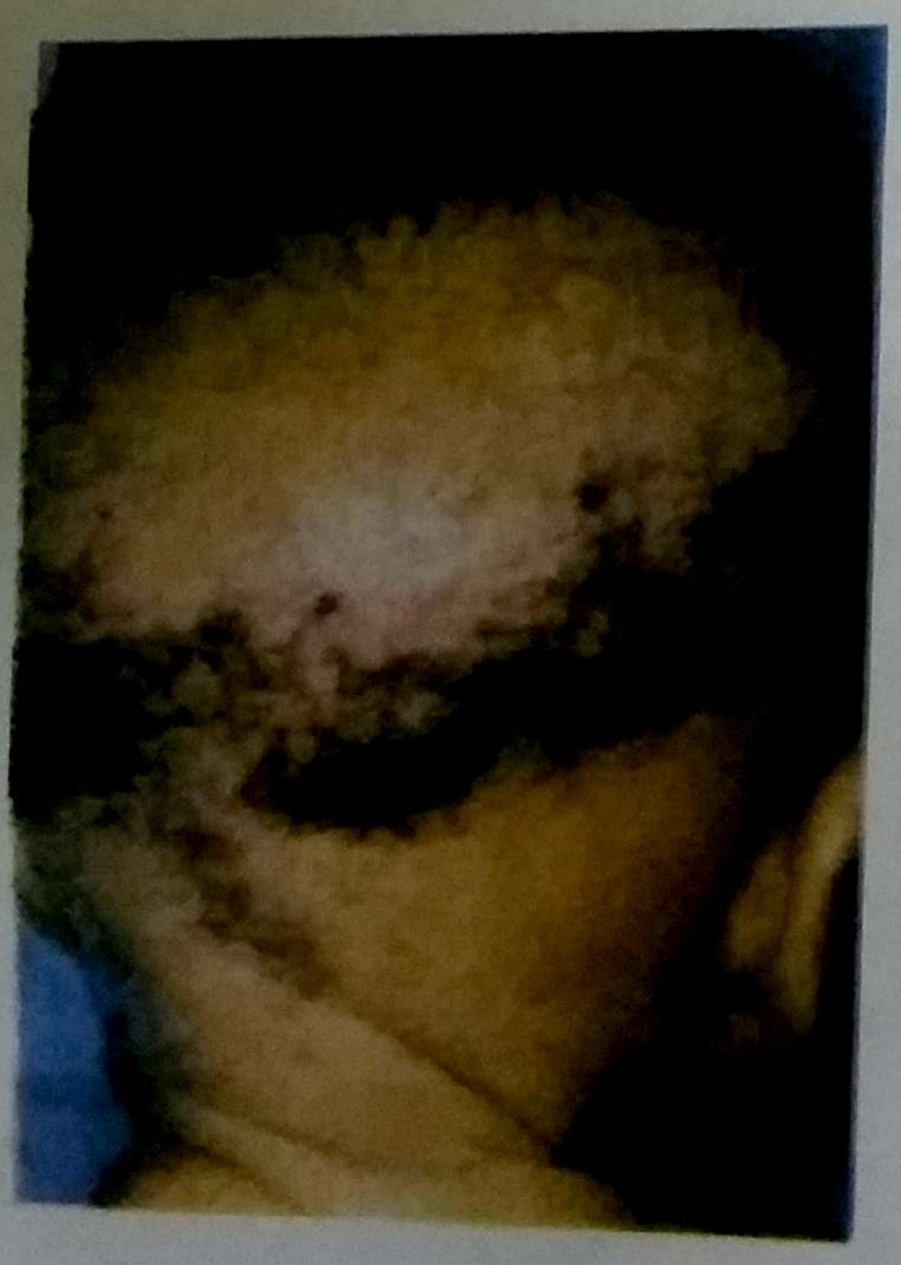
### How to examine ?

It is best elicited by holding the infant's head between the palms of the hands , the thumbs on the forehead and the fingers are fanned out over the occiput. When gentle pressure is expressed over the occipital region , the skull yields under the fingers ( similar to when pressure is exerted on a ping pong ball ).

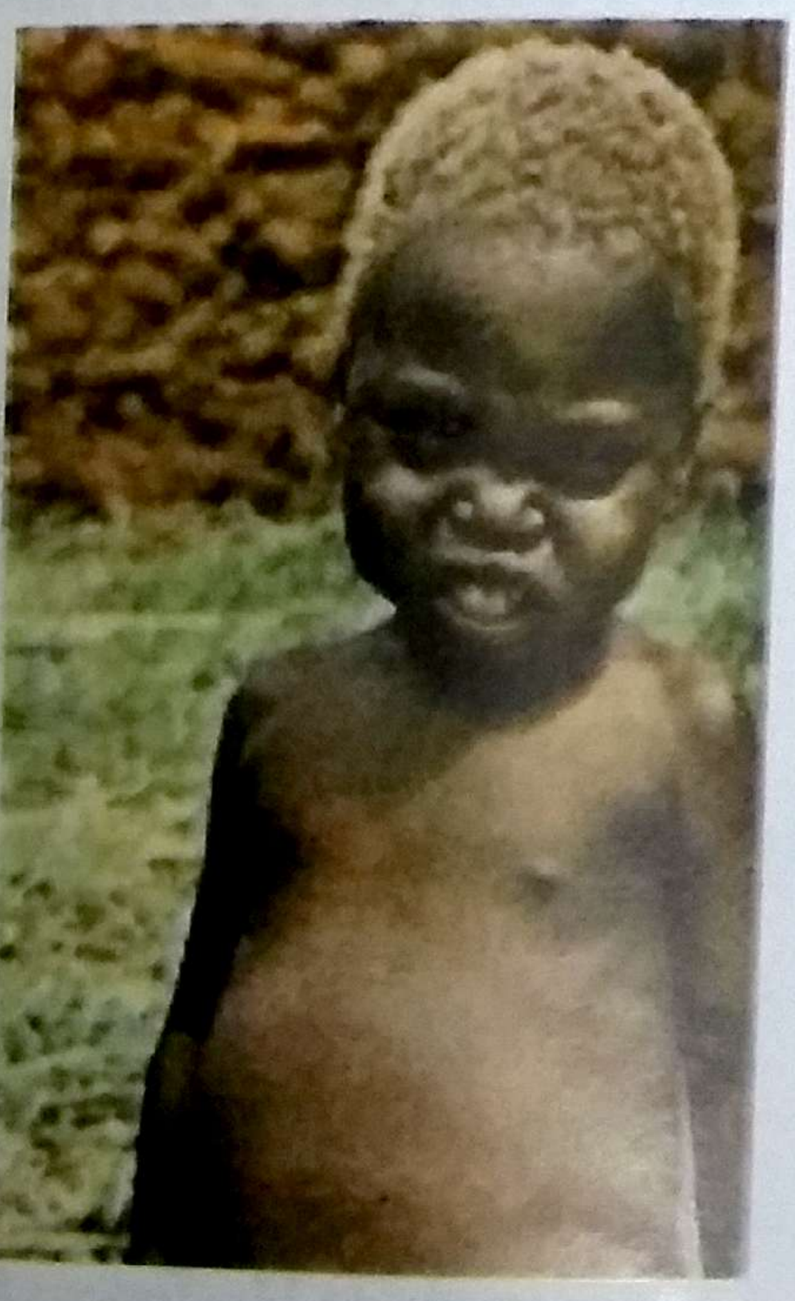
*Causes :* may be present in normal newborn ,
prematures ,
rickets and hydrocephalus.

NB : in rickets the area of softening is present away from the sutures. In rickets , craniotabes disappear between 8-10 months of age when the infant can sit and rate of growth of the brain decreases.

## 6- Hair : - Loss of hair with dyspigmentaion is seen in Kwashiorokor .



*Hair loss in Kwashiorkor*



*Red hair in kwashiorkor*

- *Hirsutism* : excessive hair growth in androgen dependent areas of the skin. The commonest sites are : moustache ,beard area and back.
  Causes include : congenital adrenal hyperplasia, ovarian or adrenal tumors , hypothyroidism , drugs as minoxidil , phenytoin.

- *Hypertrichosis :* is excessive hair growth in non androgenic areas.
  Causes include : mucopolysaccharidosis , malnutrition. drugs as corticosteroids .

- *Hypotrichosis :* deficent hair growth.

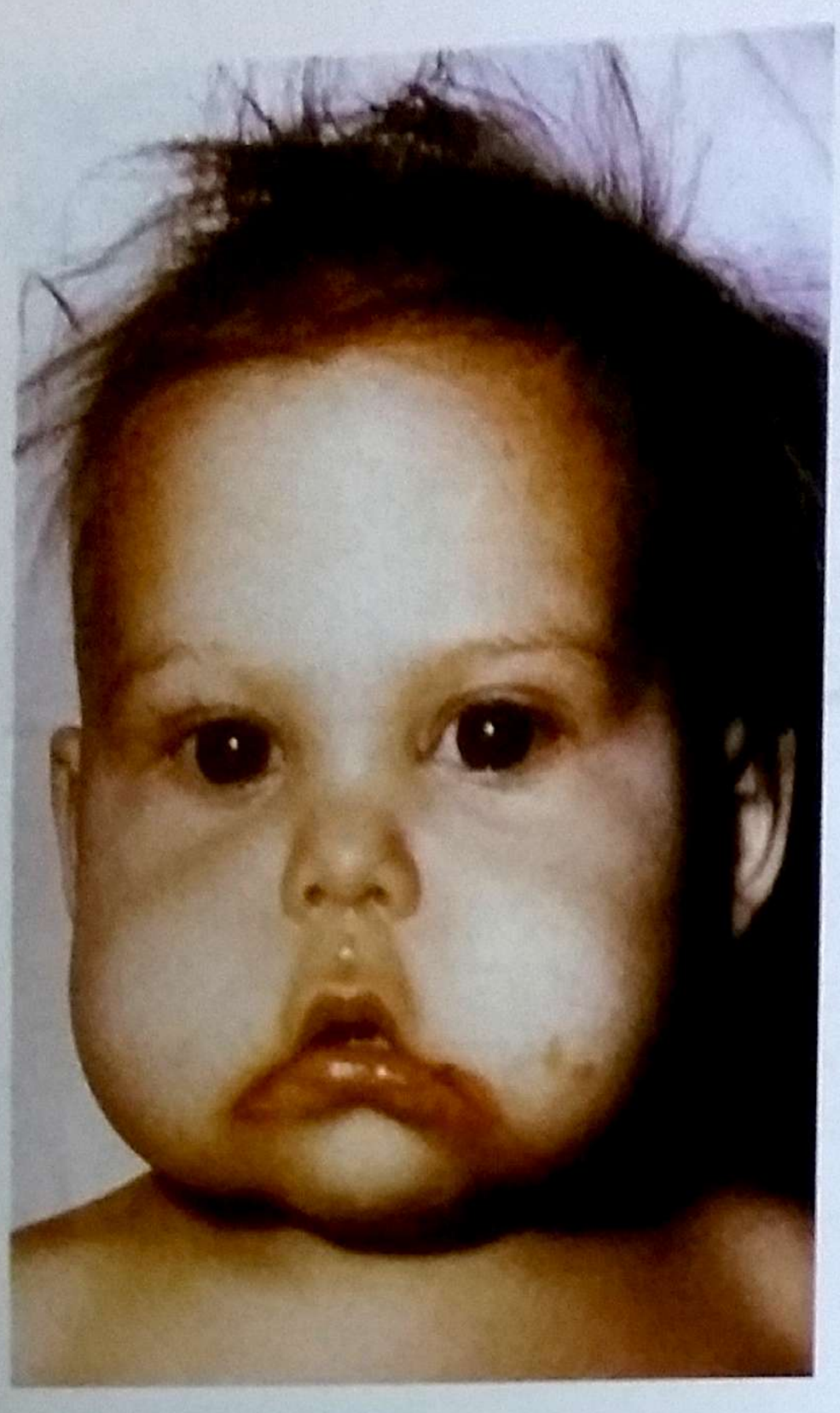
- *Alopecia :* hair loss ( partial or complete): in PEM ,Cytotoxic drugs, SLE , Hypothyroidism , Zinc deficiency….,etc.

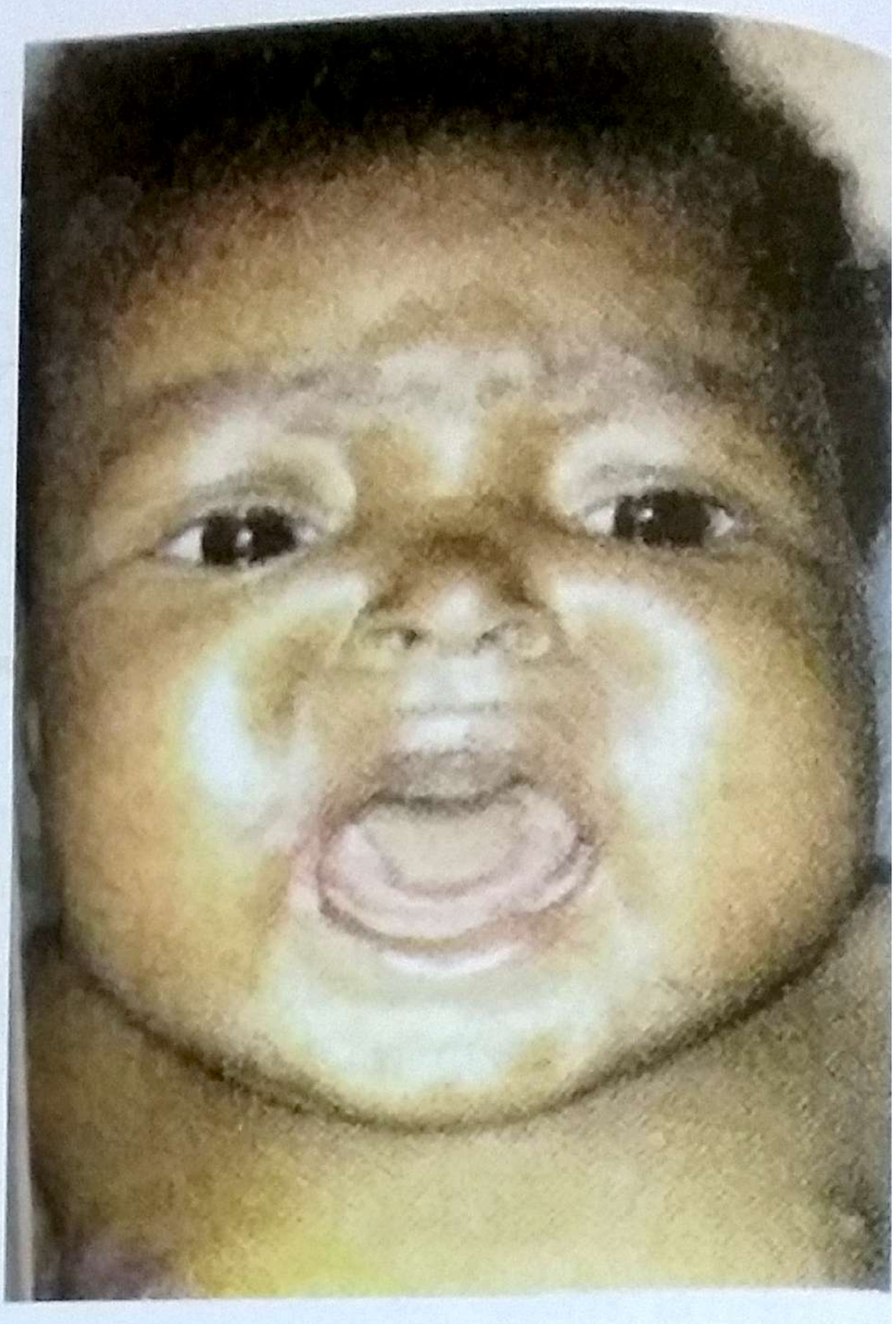
## Examination of the Face :

### A- Facial Features :

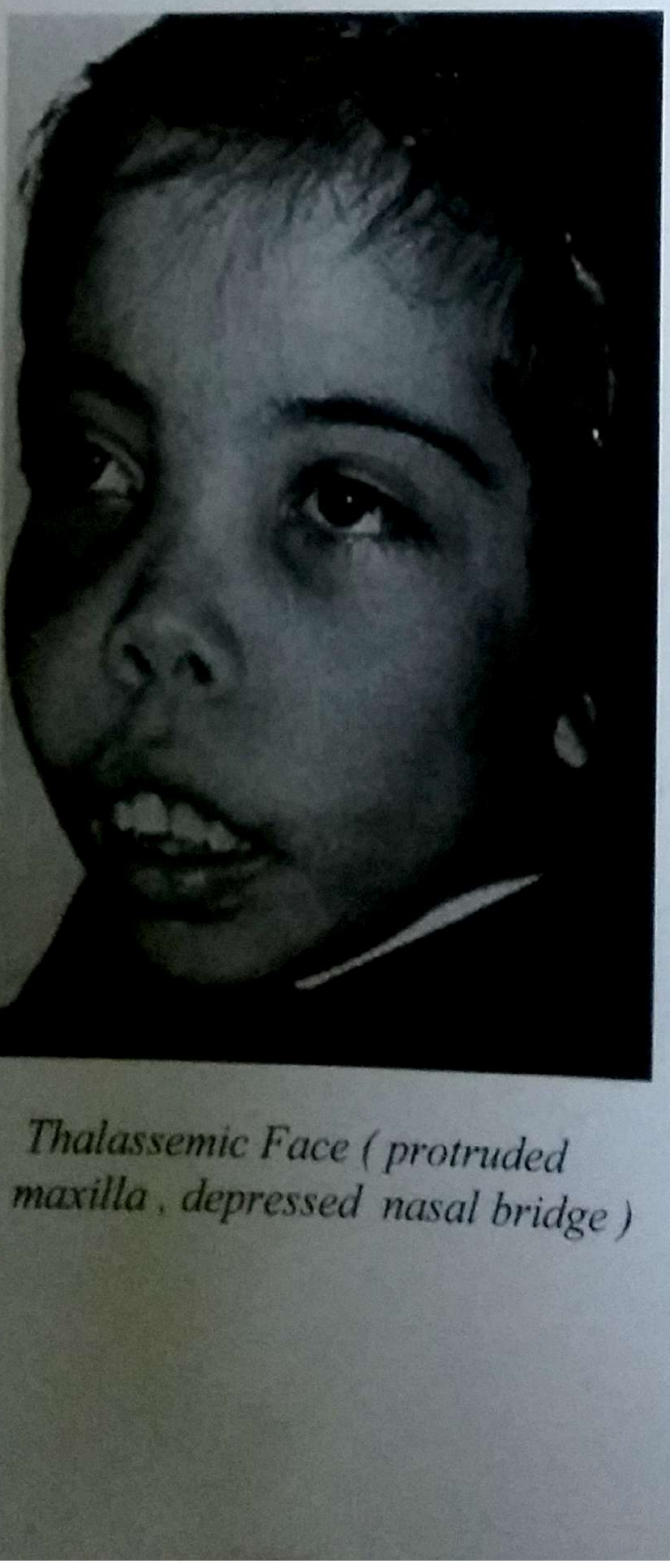
Special features are seen in cases of Down syndrome, cretinism.
Asymmetric face is seen in parotid swelling as Mumps or facial palsy.

In marasmus , the hollow cheeks give the appearance of old man face; while in Kwashiorkor , the edematous cheeks give doll like face.
In thalassemia, the face has special features with protrusion of the maxilla and depression of the nasal bridge.

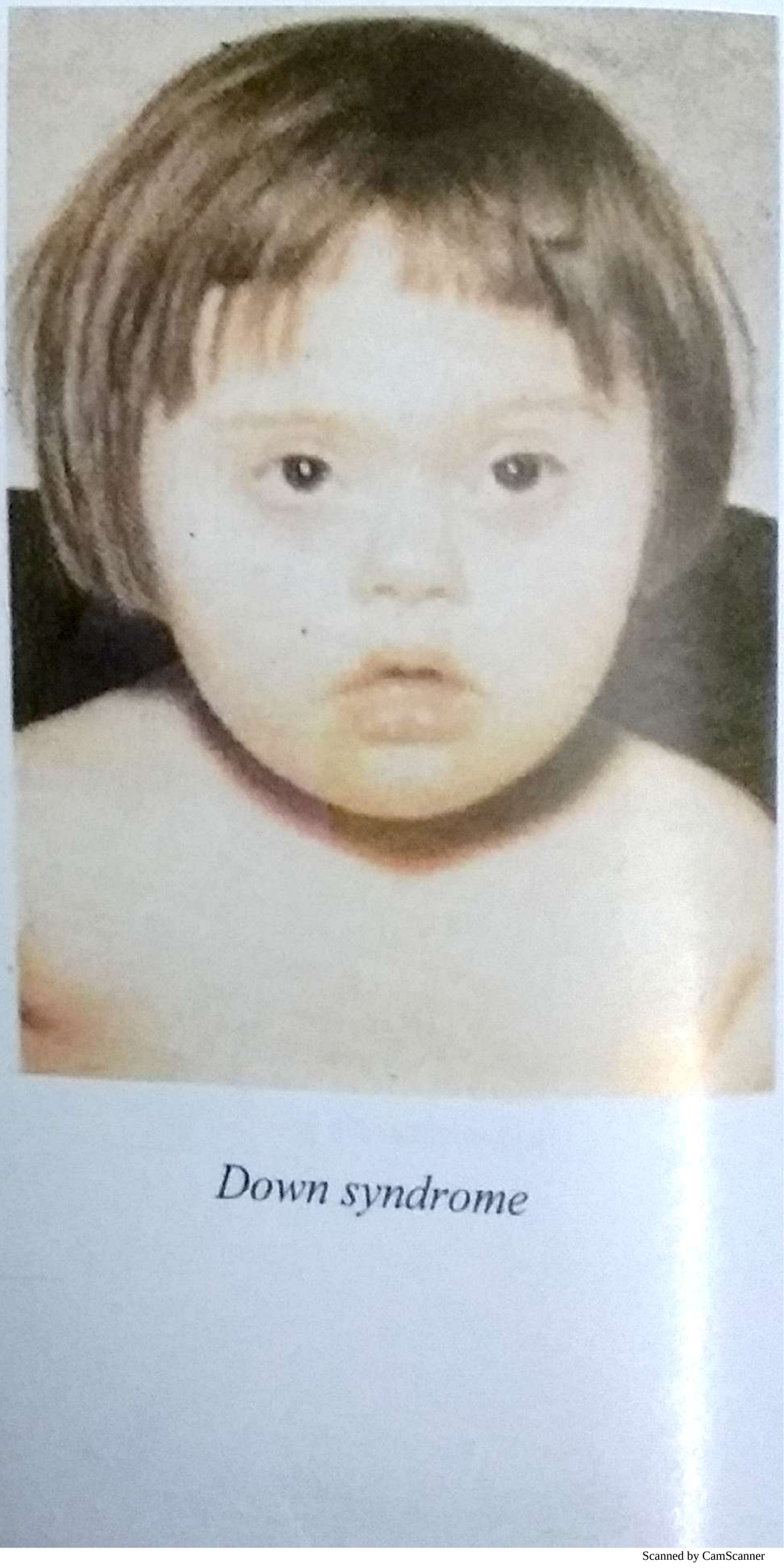




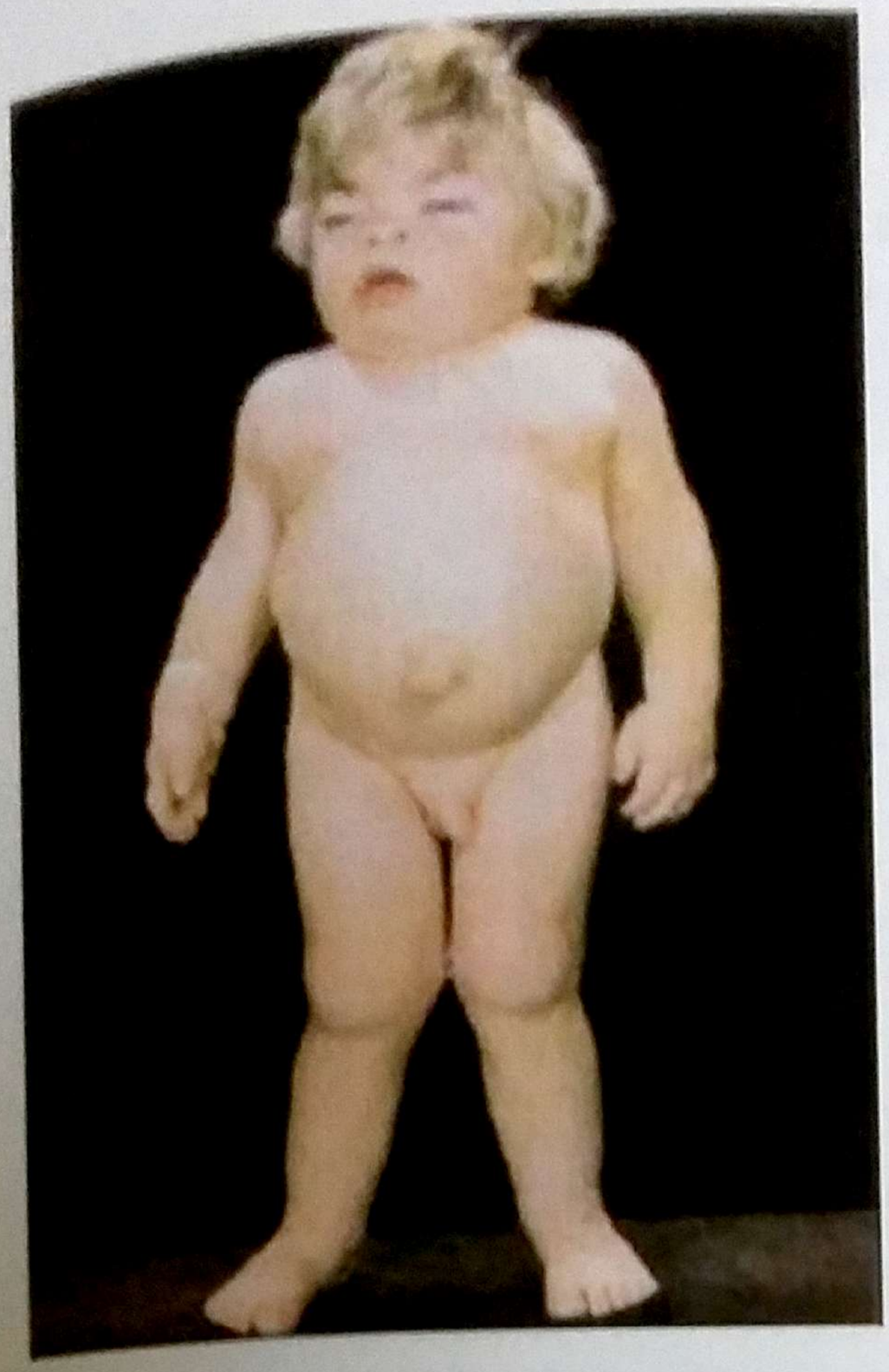
*Kwashiorkor ( note bulky sagging cheeks called doll's ckeeks)*



*Thalassemic Face ( protruded maxilla , depressed nasal bridge )*



*Down syndrome*

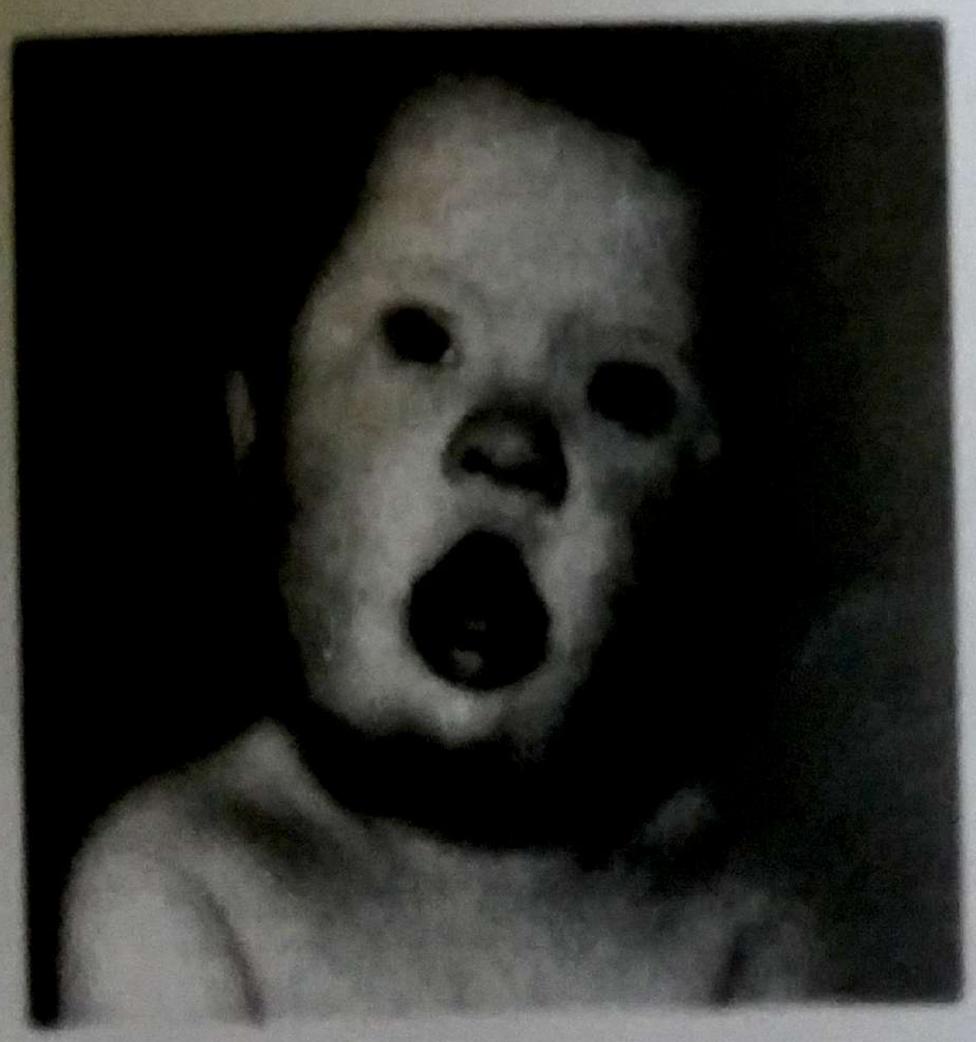


*Mucopolysaccharidosis*
(short stature, coarse features
protruded abdomen , kyphosis
hepatosplenomegaly)

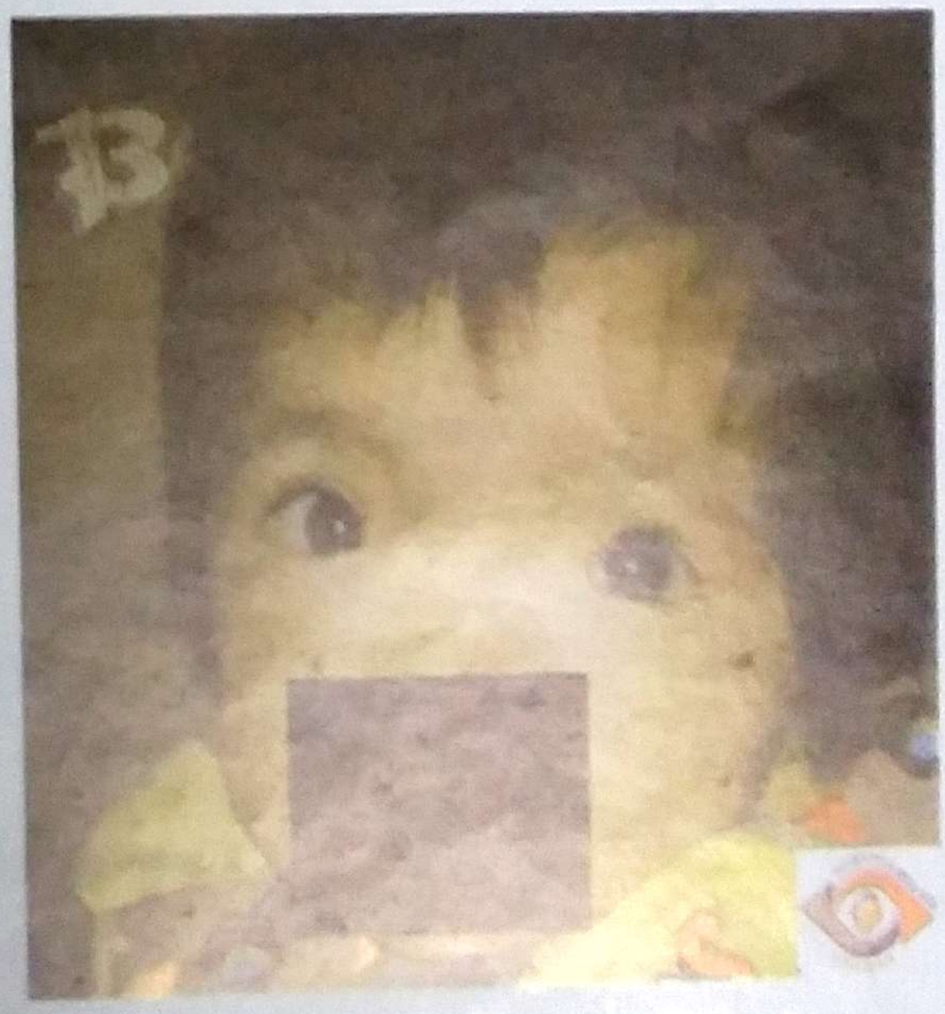
*Cretin ( note puffy eyes , thick*
Protruded tongue )

B-Eyes :

1- *Position and Placement* : normally , the distance between inner canthi =2.5cm . increased distance is called hypertelorism e.g. in Down syndrome.



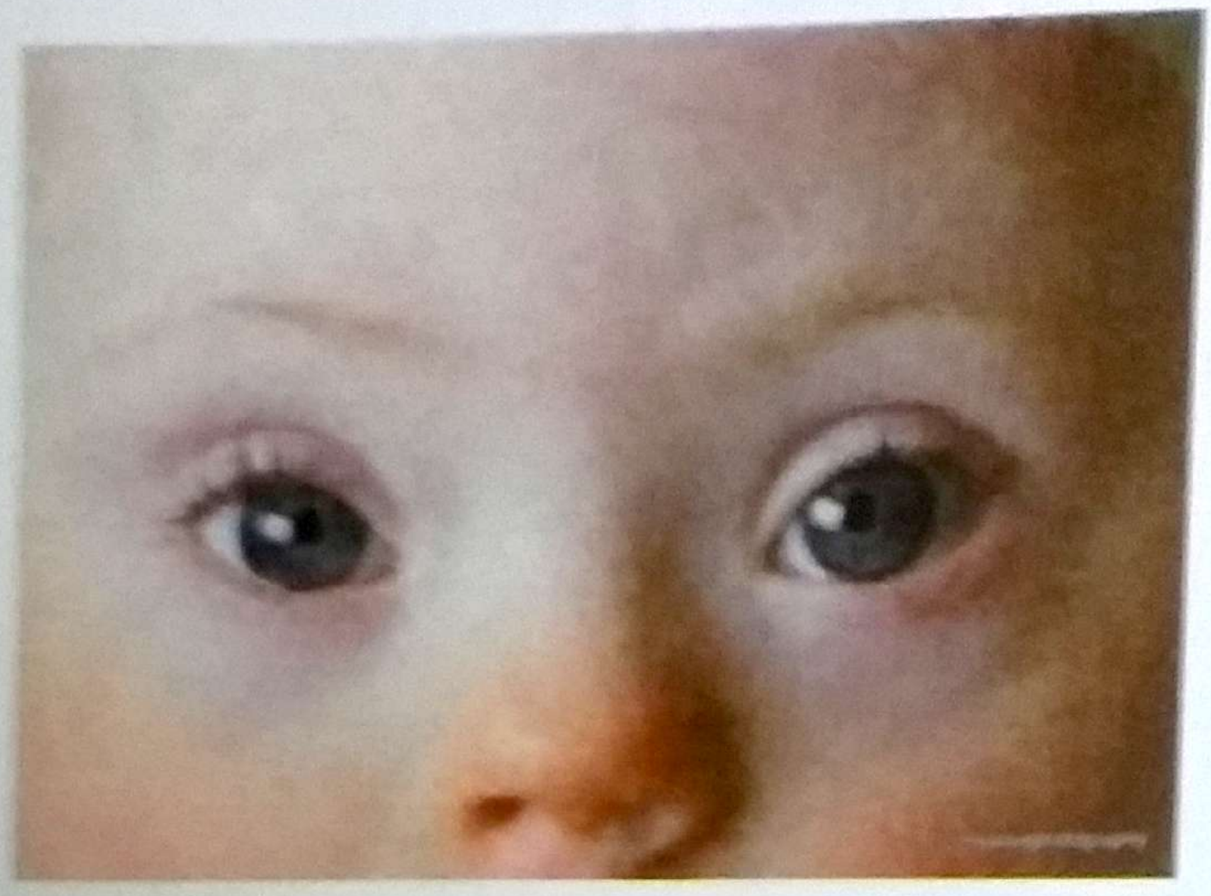
*Hypertelorism in Down syndrome*



*Hypertelorism*

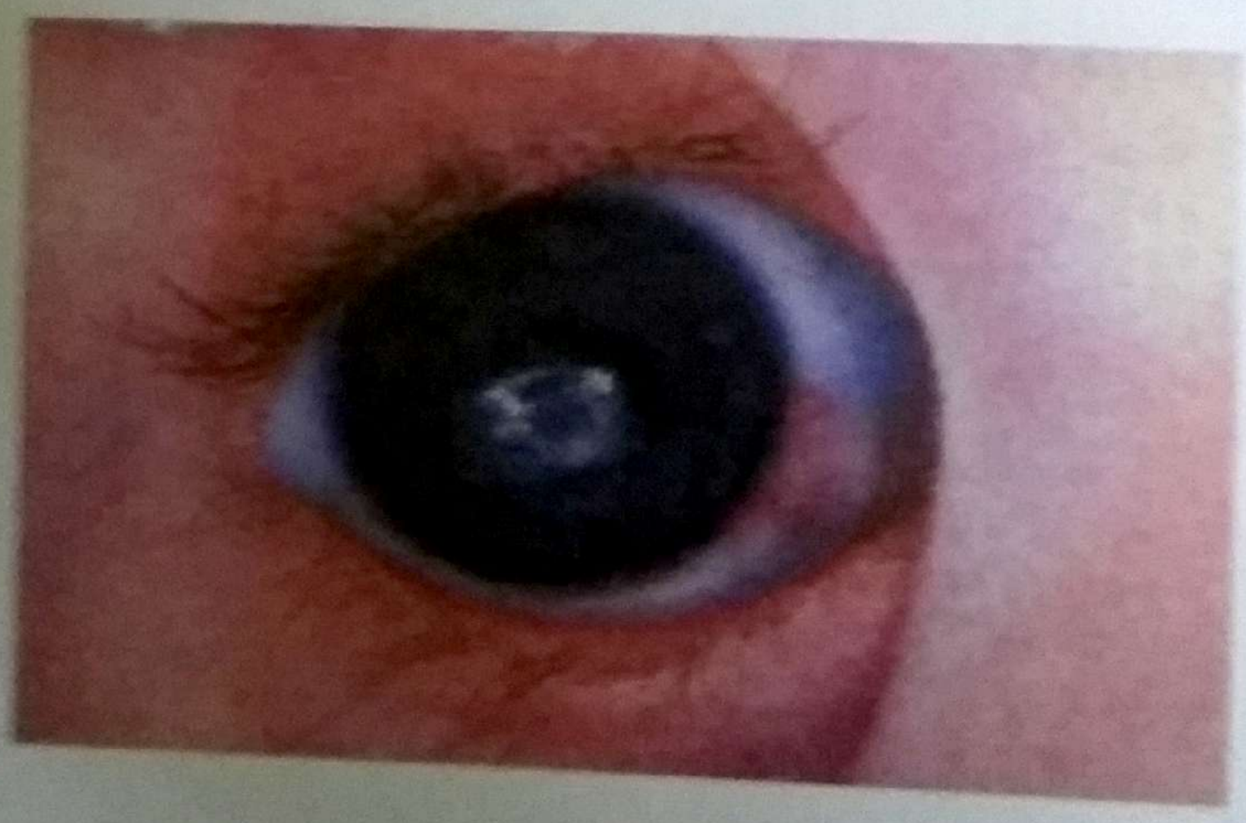
2- *Palpebral Fissure ( slant of the eyes) :*

Observe the slant of the eyes by drawing an imaginary line across inner canthi and extended to the occiput . In normal eyes the outer canthi should be present on the same line as the inner canthi.



*The slant of the eyes in Down syndrome is directed upwards ( i.e. The outer canthi are present above the imaginary line drawn from one inner canthus to the other and extended to the occiput).*

3- *Epicanthic folds* : A vertical skin fold that partially or completely covers the inner canthi . In Down syndrome , epicanthic folds are usually evident

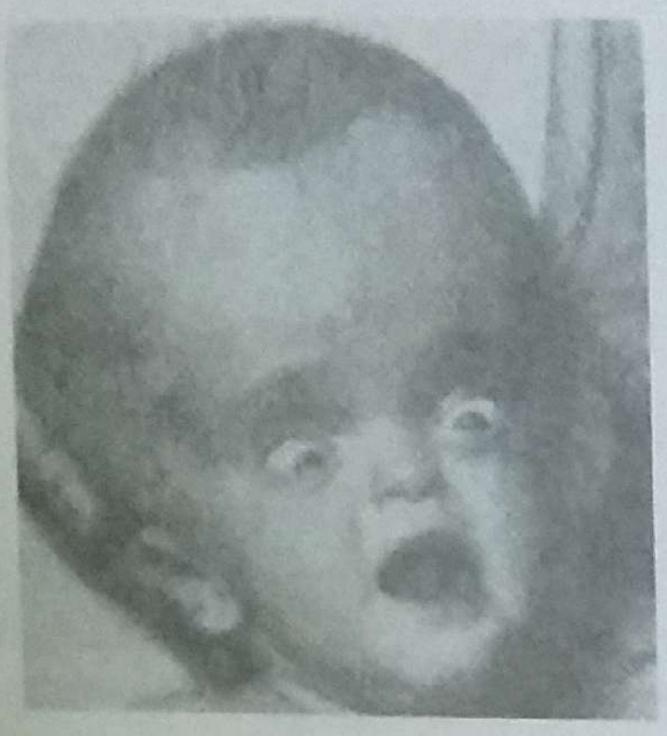


*Epicanthic fold in the right eye*

4- *Eyelids* :

-The margin of upper eye lid should fall between the upper border of iris and the pupil when the eye is opened.

-If the sclera above the iris is seen = Sun-setting eyes , seen in hydrocephalus .

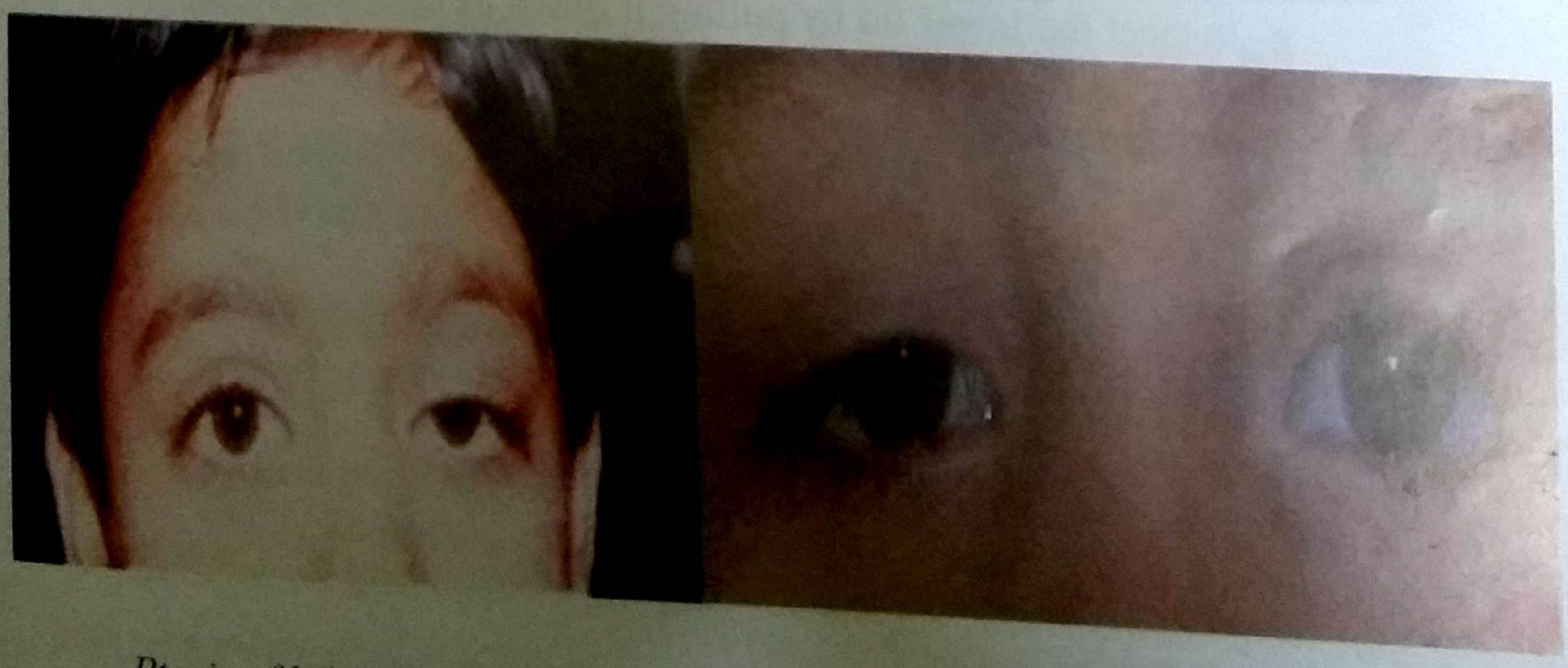


*Sun setting sign : eyes deviated downwards with a rim of sclera above the iris.*

- Ptosis may be normal (a normal variant) or may indicate paralysis of oculomotor nerve .

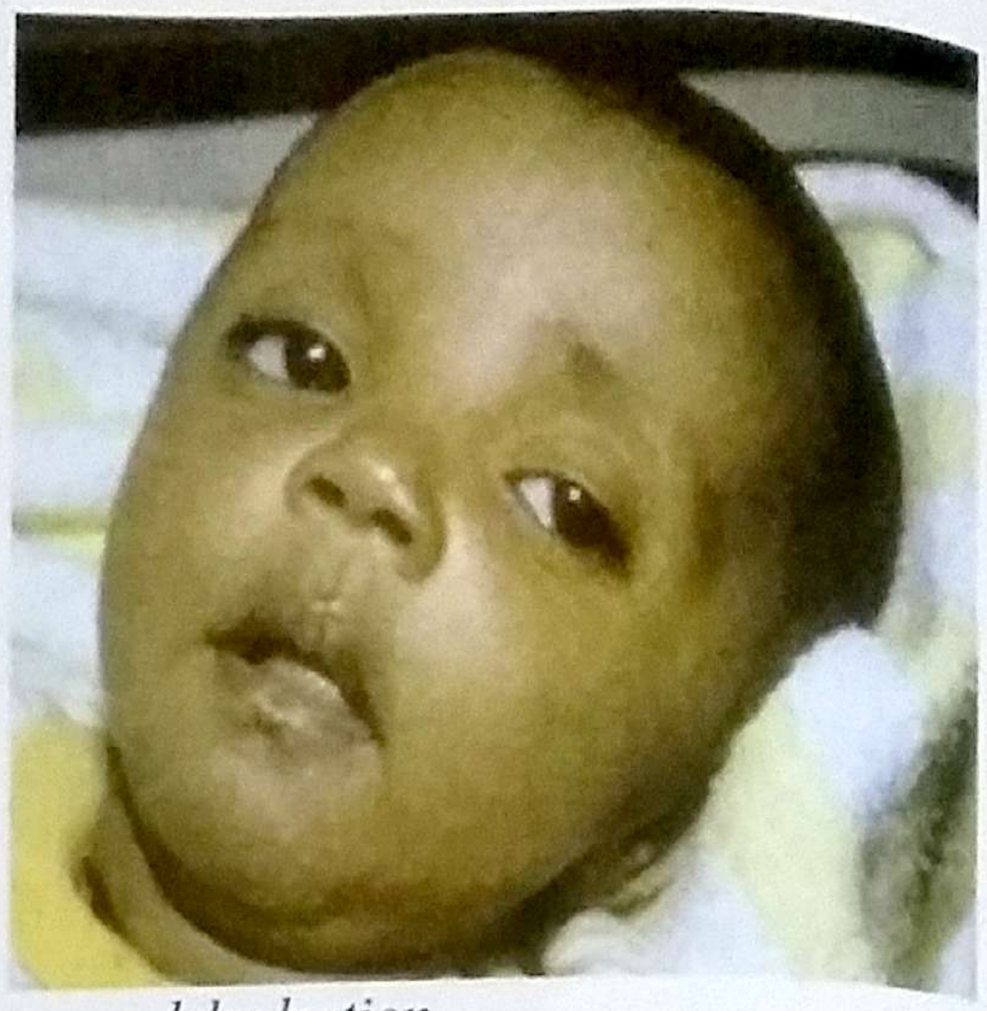
- Edema of the eyelids : in glomerulonephritis , nephrotic syndrome , Kwashiorkor , marasmic kwashiorkor, heart failure ,allergic edema as well as crying or recent sleep.

- Sunken eyes : the area around the globe of the eye appears sunken , seen in dehydration and marasmus.



*Ptosis of left upper eyelid*

*Ptosis of right upper eyelid*



*Sunken eyes in severe dehydration*

*Puffy eyes*

*Puffy eyes*

*after treatment*

5- Conjunctiva :

**a-** Inspect the lower lid by pulling it down as the child looks up. Inspect the upper lid by rolling the eye lid over a cotton tipped applicator.

**b-** Redness of the conjunctiva ( conjunctivitis) : may be due to bacterial or viral infection or due to allergy or irritation.

**c-** Pallor of conjunctiva is due to anemia.

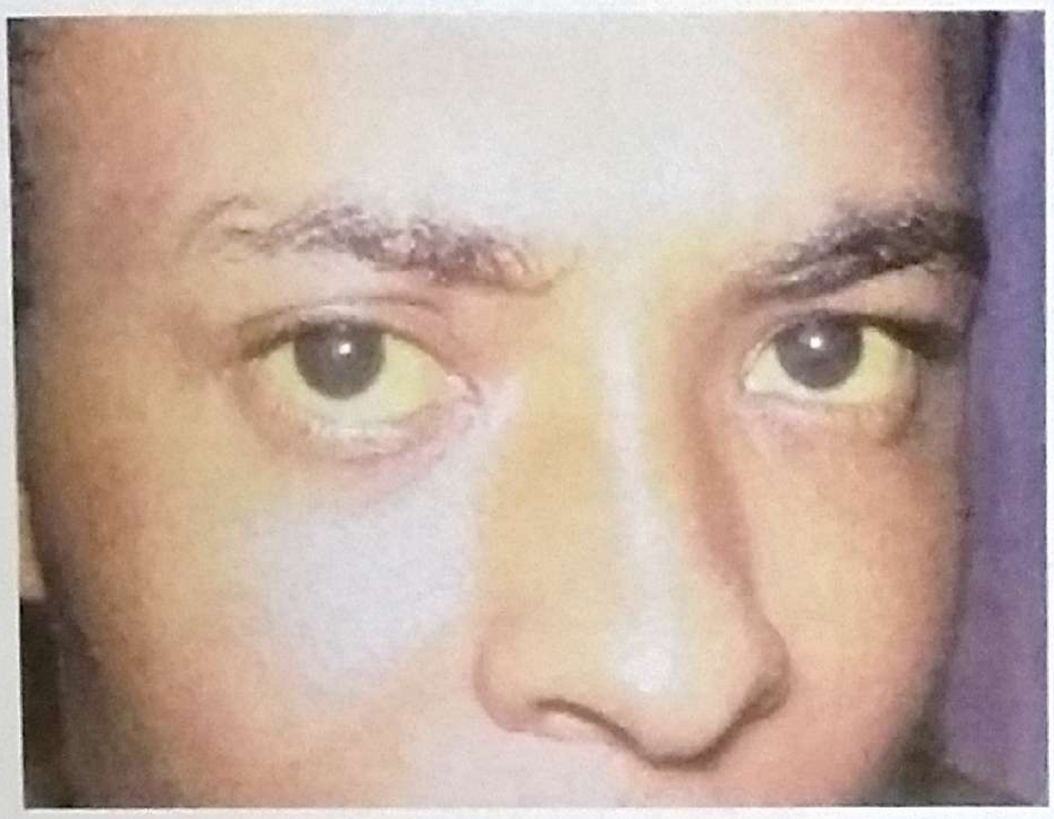
**d-**The bulbar conjunctiva should be clear and transparent allowing the white color of the sclera to be clearly visible. Redness occurs in conjunctivitis.

**e-** In vitamin A deficiency : dryness of conjunctiva ( xerophthalmia ) and Bitot spots ( white plaque on bulbar conjunctiva ) may be present.

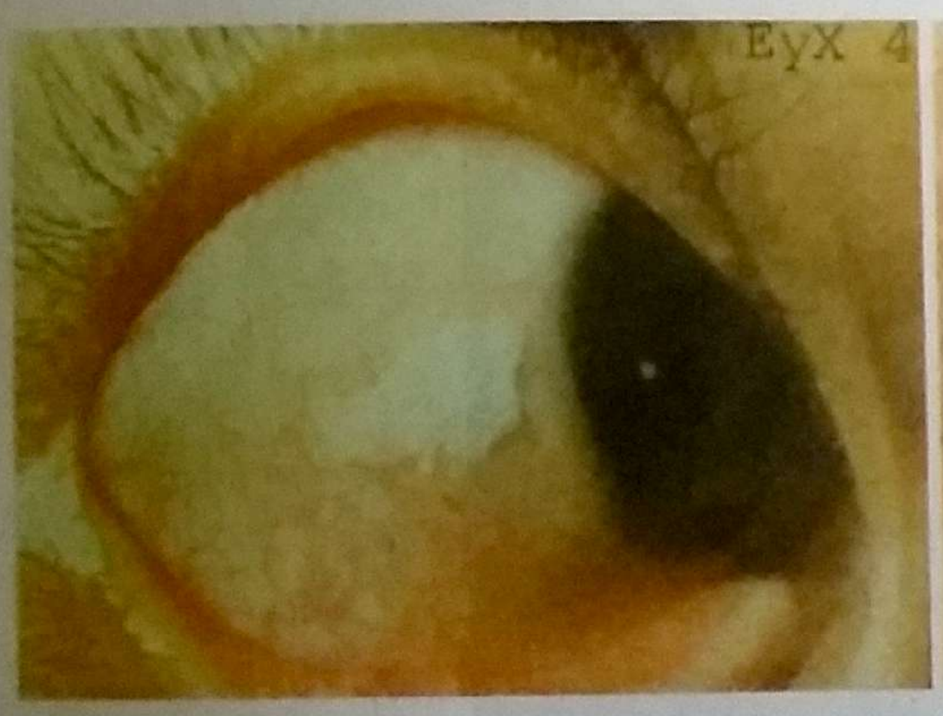
*Conjunctivitis due to viral infection*

6- *Sclera* : The sclera should be white in color. Bluish discoloration is seen in glaucoma and osteogenesis imperfecta. Yellow sclera is seen in jaundice.

*Blue sclera in congenital glaucoma*
*Note the large size of cornea*



*Yellow sclera in jaundice*




Bitot spots ( white plaque on bulbar conjunctiva)

Xerophthalmia (dryness of the conjunctiva)

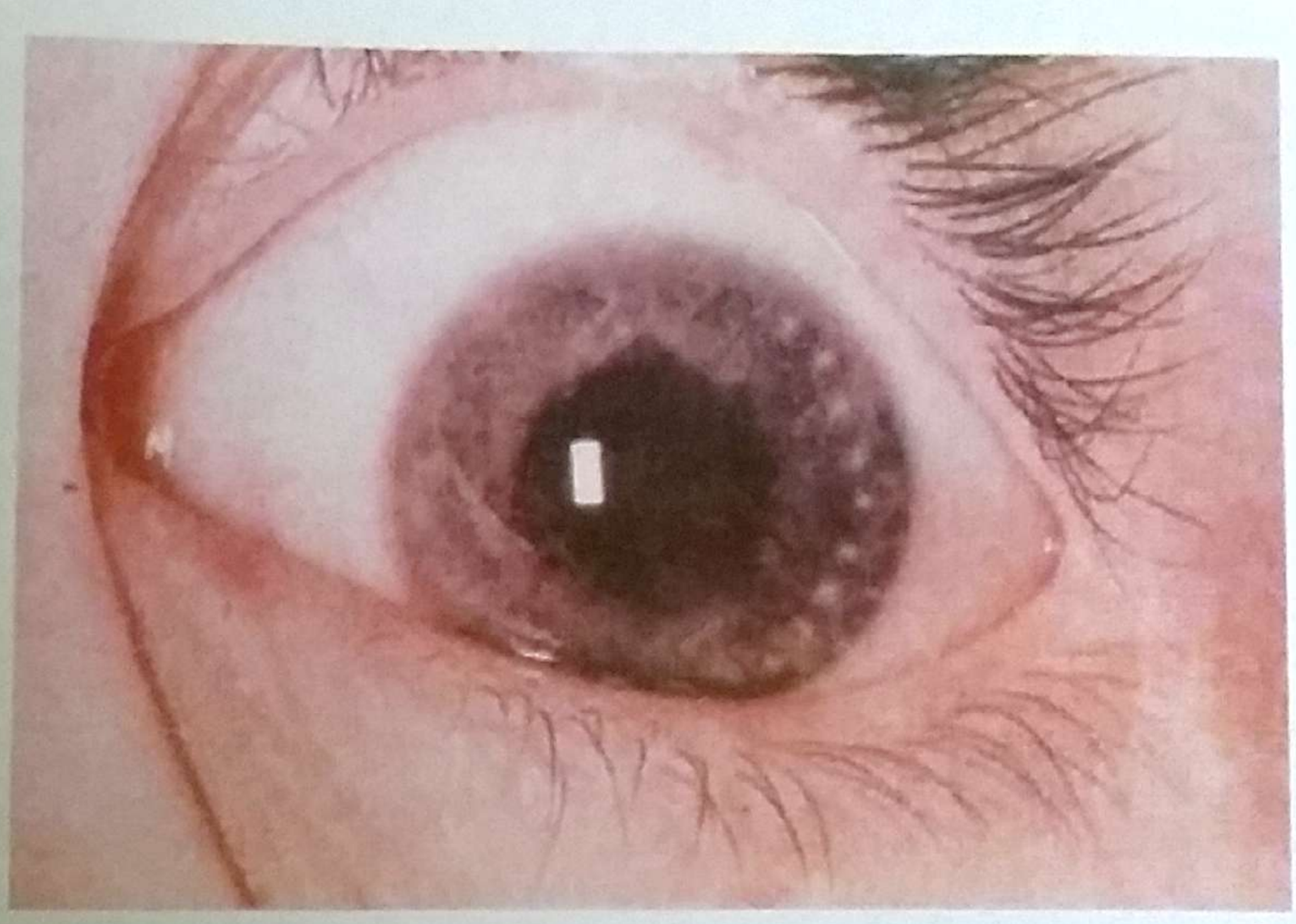
**Eye manifestations in Vitamin A deficiency**

7- *Cornea* : The cornea in the newborn infants has a diameter of 9-10 mm. Megalocornea ( >13 mm ) occurs in congenital glaucoma.

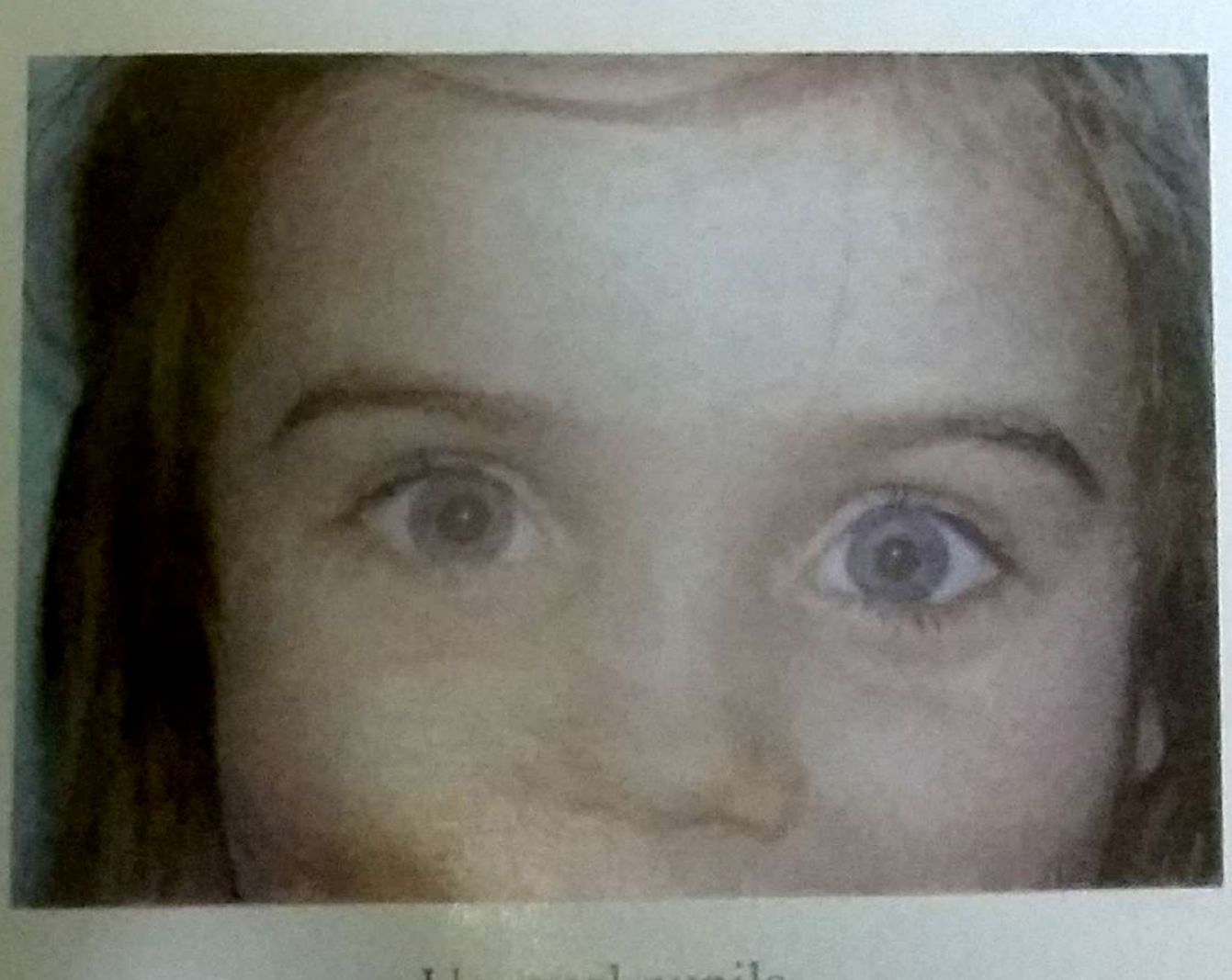
The cornea is normally clear , corneal opacity is seen in a number of metabolic disorders as mucopolysaccharidosis. Corneal ulceration is a feature of keratomalacia ( vitamin A deficiency)and herpes simplex ( dendritic ulcer).

8- *Pupils and iris :*

-Brushfield spots in Down syndrome.
-Constricted pupils : e.g. in organophosphorus poisoning.
-Dilated pupils in circulatory arrest , anaesthesia, acute glaucoma.



*Brushfield Spots in left eye ( silvery white spots at the periphery of the iris . Note the epicanthic fold )*



Unequal pupils

9- *Cataract* :

It may be congenital : in intrauterine infections . galactosemia, Down syndrome

Or acquired due to drugs (as corticosteroids) or trauma.

*Congenital cataract*

10- *Squint* : may be normal in the first 6 months of life .

- Non paralytic squint may be congenital or acquired ( due to ocular or visual defects as lesions of optic nerve ,or macula or high refractory errors.
- Paralytic squint ( weakness of extra-ocular muscles) : may occur in IC tumors , IC infections , neurodegenerative disease , myasthenia gravis or myopathy.

11- *Nystagmus* : ( rhythmic oscillation of one or both eyes ).

It may be congenital e.g. in Down syndrome or congenital optic atrophy .

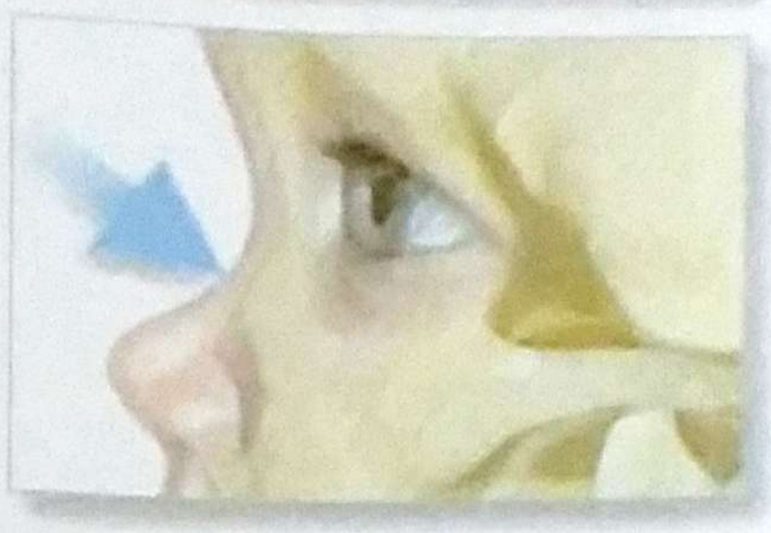
Acquired nystagmus : e.g. in diseases of cerebellum .

## C-Nose :

- Depressed nasal bridge in :
  - Black children
  - Cretinism
  - Down syndrome

Normal nasal bridge

Low nasal bridge



- Acting alae nasi :

In respiratory distress : e.g. pneumonia .

- Nasal discharge :

Watery in allergic rhinitis.

Purulent ( yellow or green ) in infections.

Unilateral and fetid in impacted F.B.

## D- Ears :

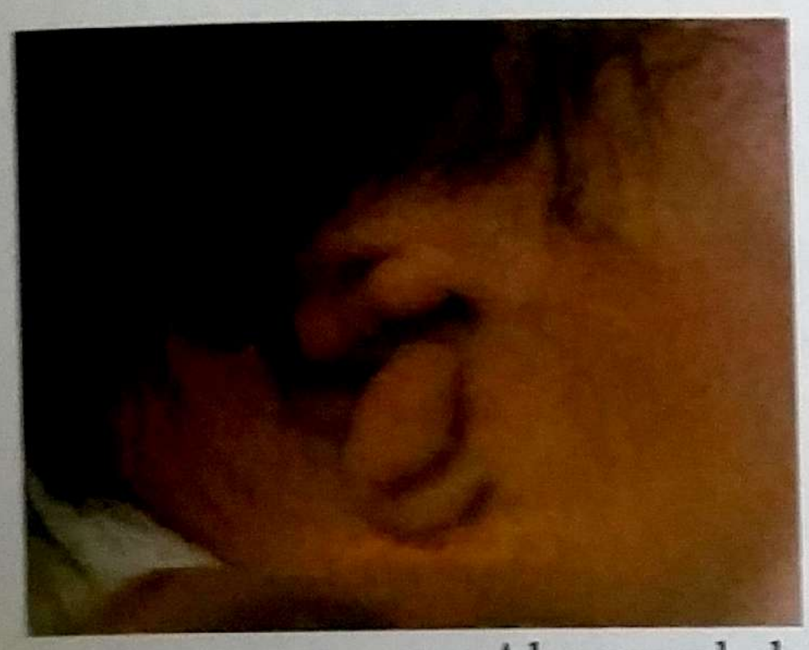
*Position :* If an imaginary line is drawn from the inner canthus of the eye to the occiput , it should cross the ear below the superior attachment of the ear pinna. If it crosses above the superior attachment of the ear → Low set ear .

**Low set ear** is seen in chromosomal abnormalities , primary microcephaly .

Normally developed outer ear (pinna)

Abnormal size, shape, rotation and/or location of pinna

*Low set ear*



Abnormal shapes of ear pinna

*Shape :* look for any deformity in shape .

*Ear discharge* :

-Foul smelling yellowish or greenish discharge is present in otitis media ( after rupture of the tympanic membrane)

- Bloody : in F.B. or scratching.

*Pull on the auricle :* pulling normally does not produce pain . Pain is present in otitis media.

*Palpate the mastoid bone :* pain and tenderness occur in mastoiditis.

*Mastoiditis : Swollen, red and tender left mastoid bone*

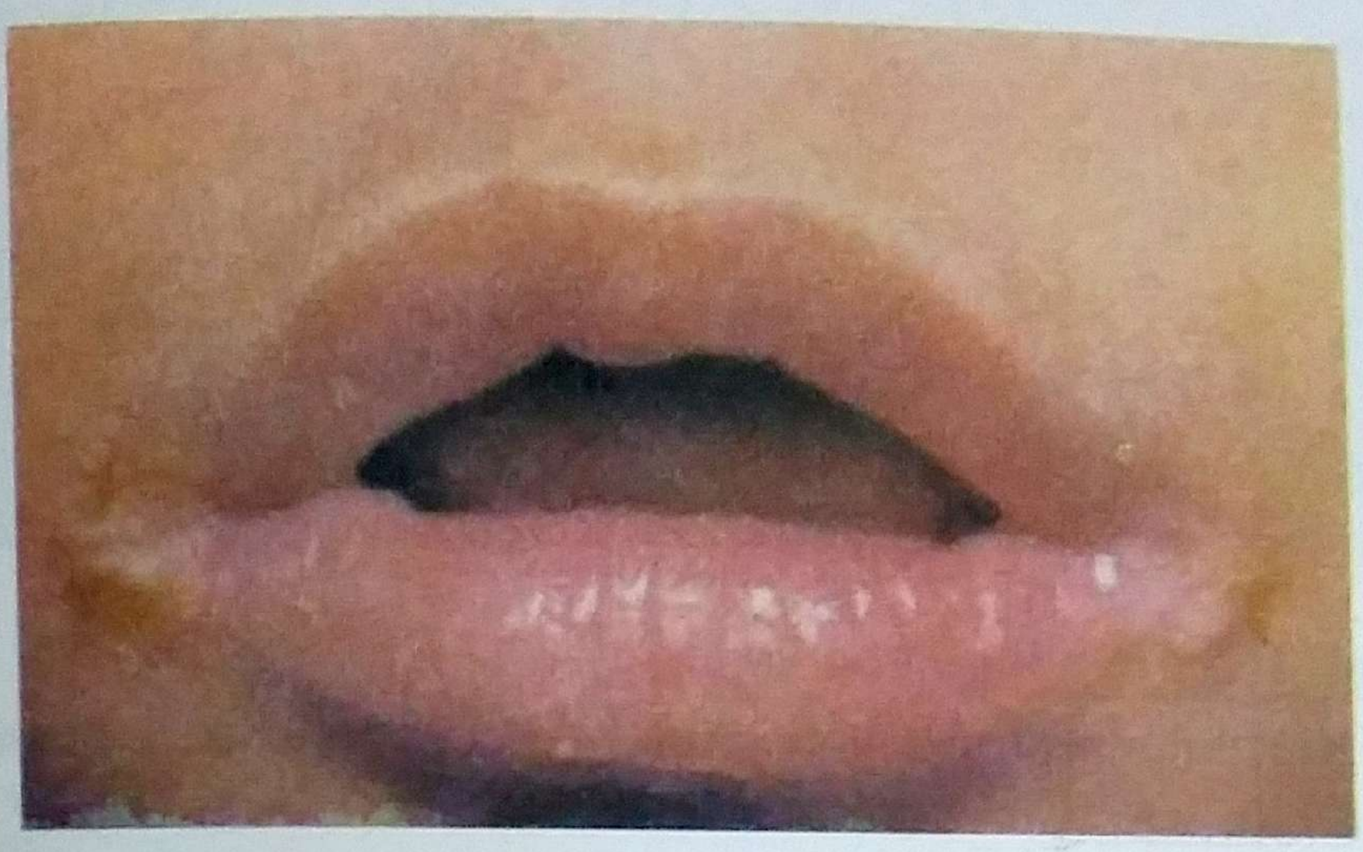
*Assess hearing* : see nervous system examination .

## E- Mouth examination :

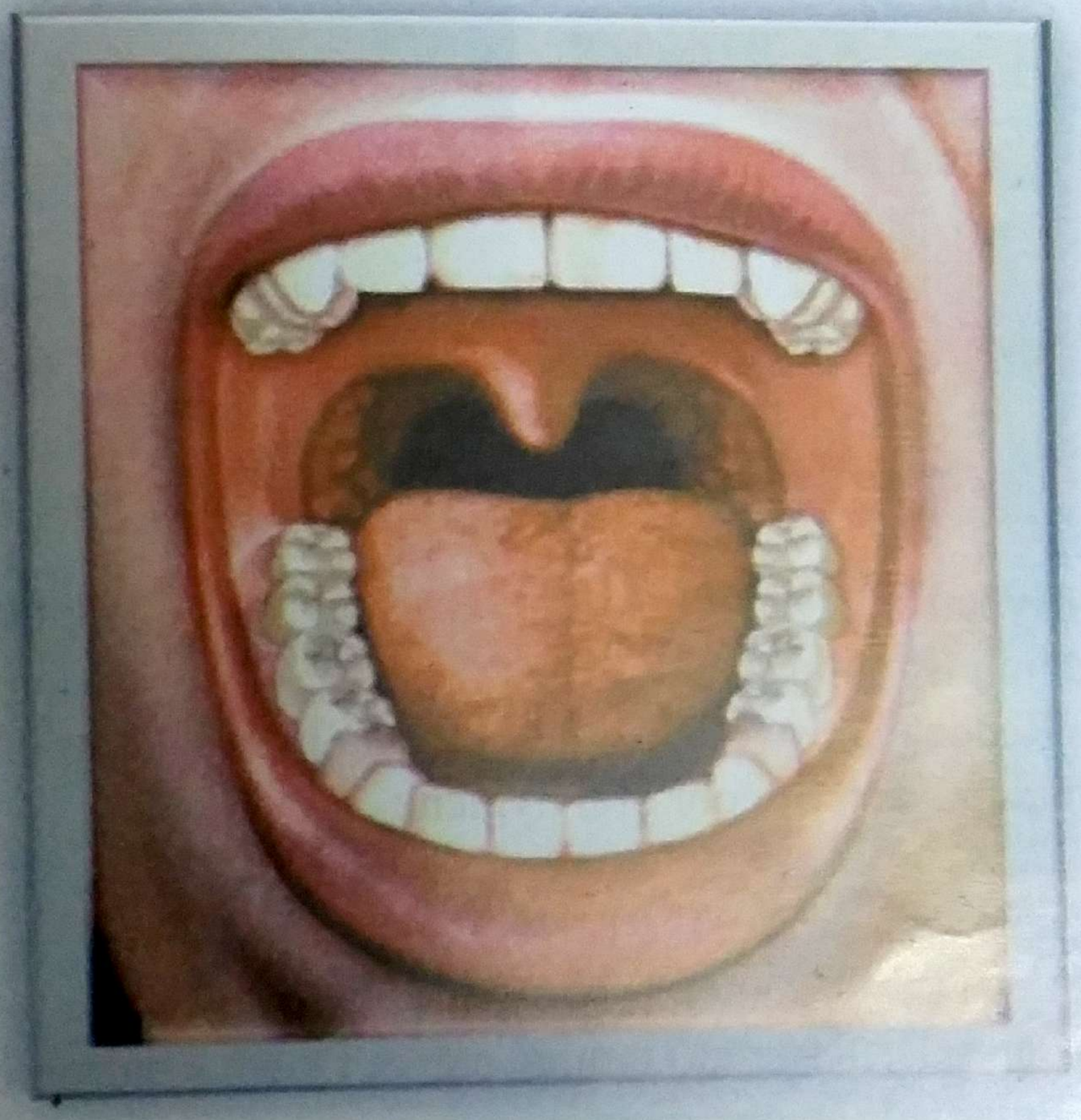
*Method of restraining the uncooperative children for mouth (& ear examination)*

1- Lips :

- for pallor ( in anemia) or cyanosis .
-Angular stomatitis = fissuring at the angles of mouth ( in riboflavin deficiency).



*Picture of angular stomatitis due to riboflavin deficiency*



*Mouth Picture seen during Examination*

## 2- Teething

| Milk teeth ( 20 teeth) | | Permanent teeth ( 32 teeth) | |
|---|---|---|---|
| Lower central incisors | 7-8months | First molars | 6-7 years |
| Upper central incisors | 8-9months | Central incisors | 6-8 years |
| Upper lateral incisors | 10-11months | Lateral incisors | 7-9 years |
| Lower lateral incisors | 11-12months | Canines | 9-11years |
| First molars | 12-14months | First premolars | 10-12years |
| Canines | 17-19months | Second premolars | 11-13years |
| Second molars | 19- 25months | Second molars | 12-13years |
| | | Third molars | 17-22 years |

**Delayed teething :** *may occur in*

Normal variation – Rickets – PEM –Down syndrome – Cretinism.

N.B. some neonates may have teeth at birth . These teeth may be false ( yellowish keratinous material that have no roots or true teeth with roots. An X-ray may be needed to differentiate . The false teeth should be removed to avoid inhalation if dislodged ).

## 3- Buccal mucosa :

- Stomatitis : Catarrhal , thrush stomatitis , herpetic gingivostomatitis
- Ulcers : Herpetic gingivostomatitis , herpangina , chicken pox or hand foot mouth disease.
- Koplik's spots : pathognomonic of measles.
- Petechiae : e.g. in thrombocytopenia .

## 4- Gums :

-Hypertrophied gums : in leukemia , phenytoin administration.

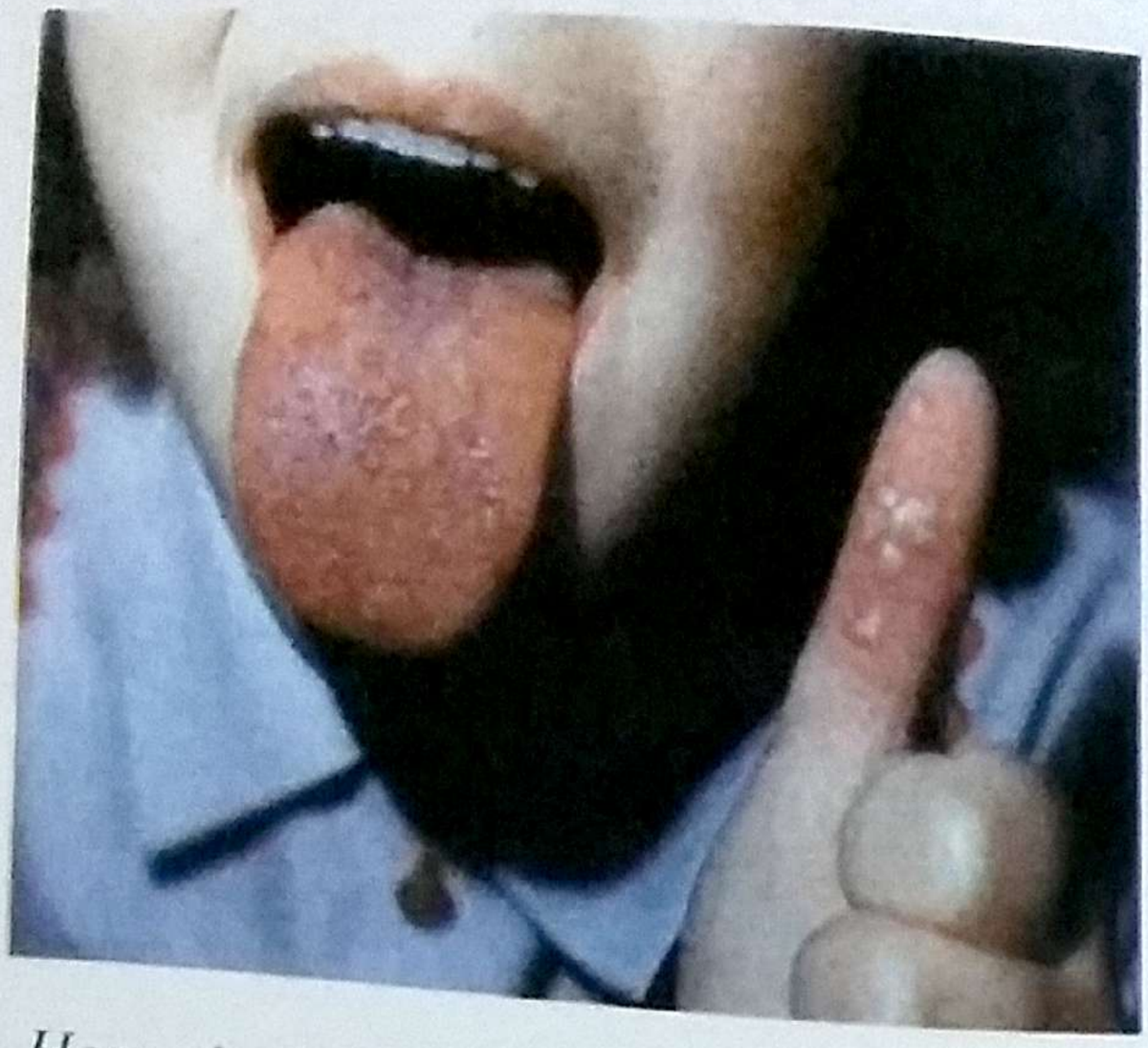
- Reddened , swollen , and bleeding gums : in infections , malnutrition or poor oral hygiene .

## 5- Tongue :

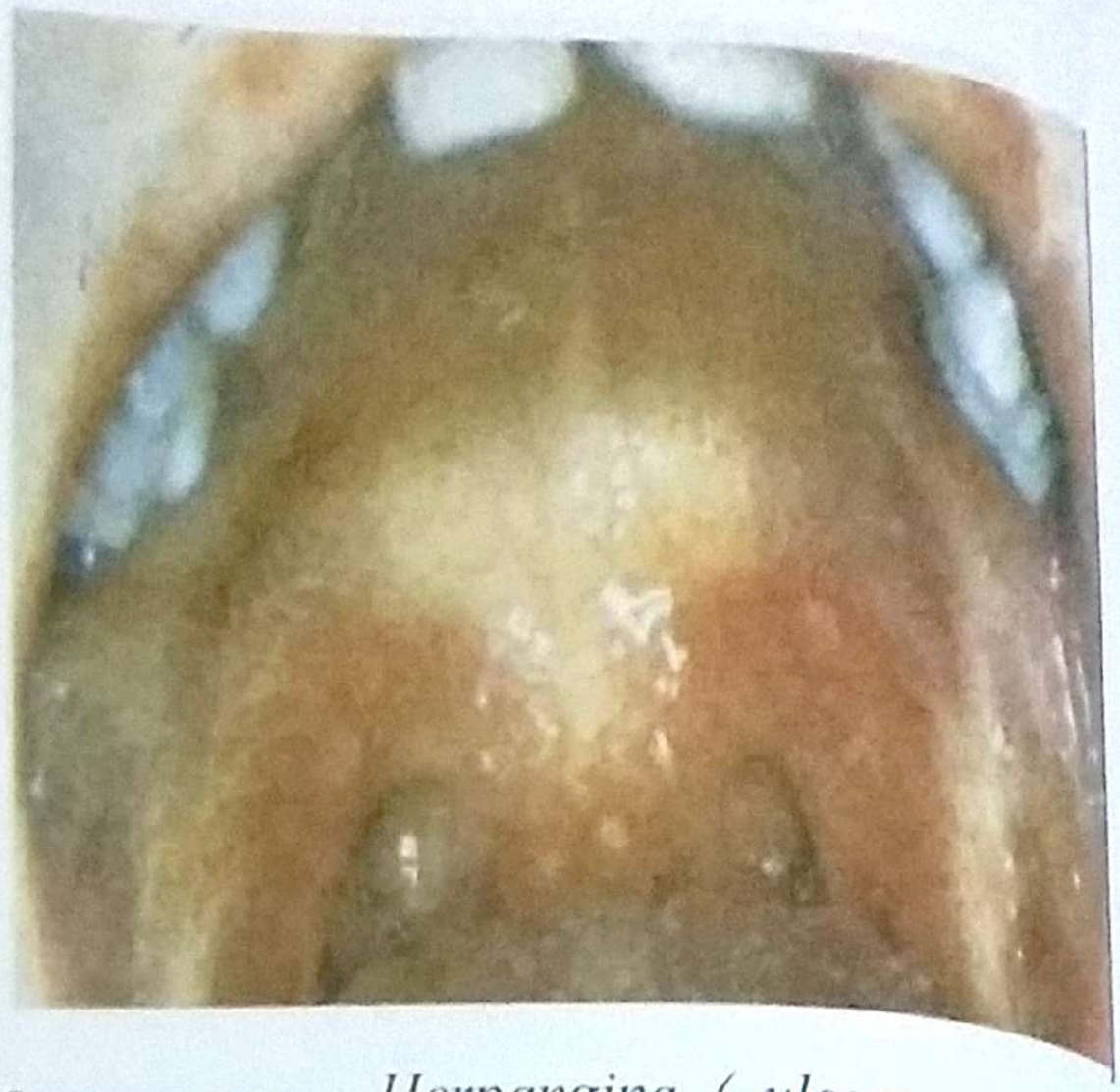
- Dry in dehydration.
- Scrotal ( fissured ) tongue e.g. in Down syndrome.
- Enlarged : in cretinism
- Strawberry tongue ( white or red) : in Scarlet fever or Kawasaki disease.

*Koplik's spots*

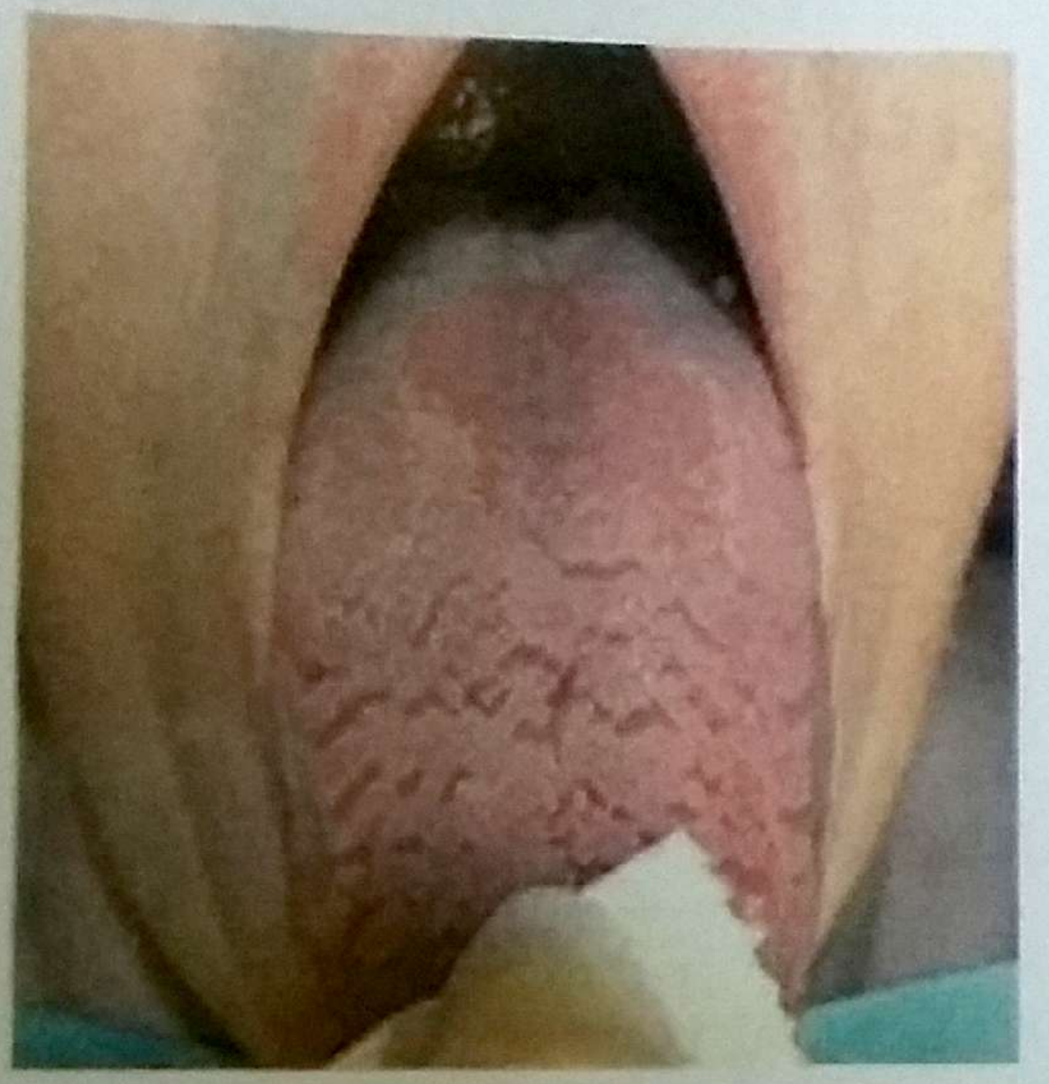
*Thrush stomatitis*



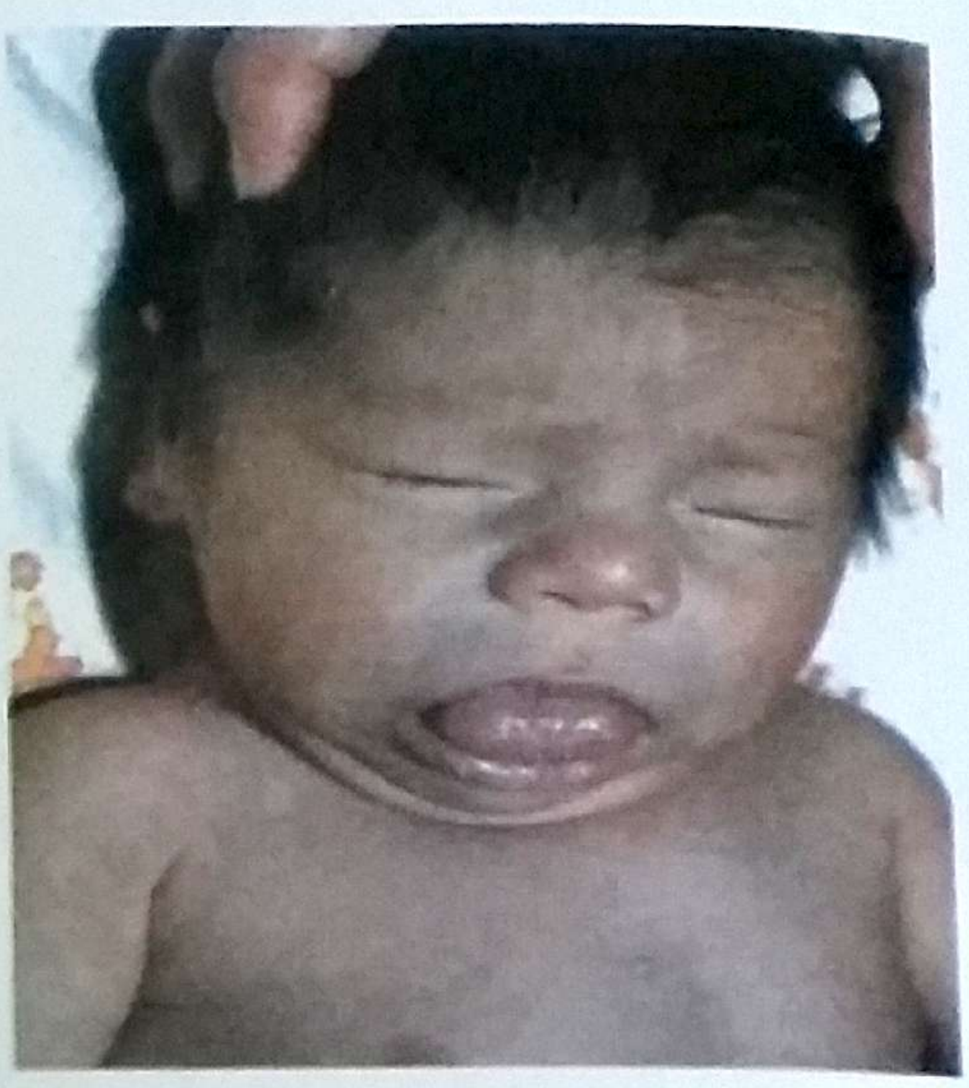
*Herpetic stomatitis ( thumb sucking →vesicles In the thumb*



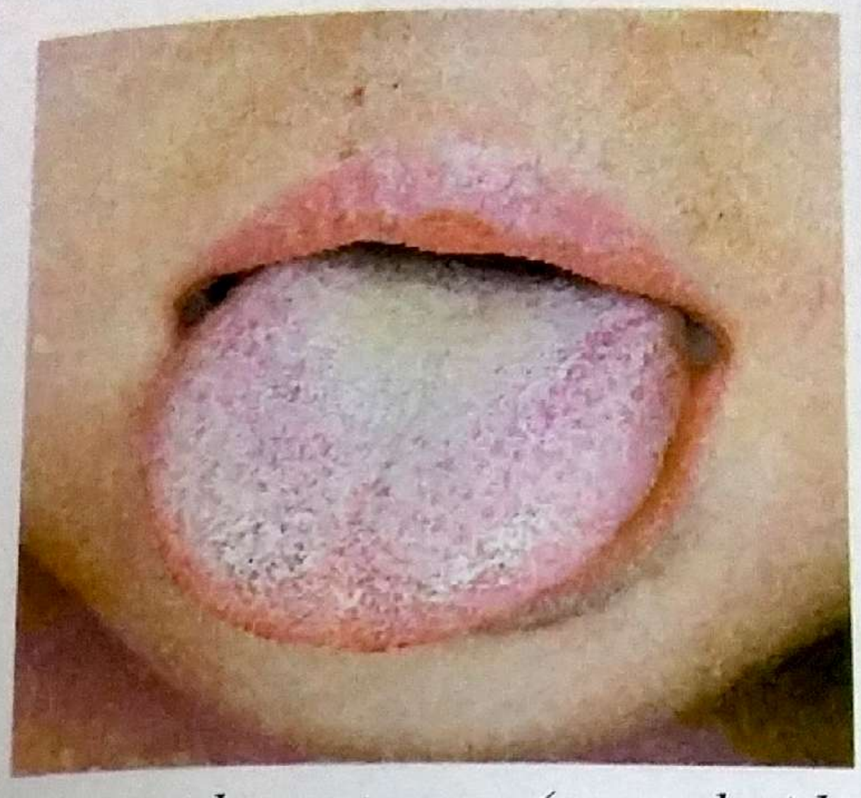
*Herpangina ( ulcers are present posteriorly)*



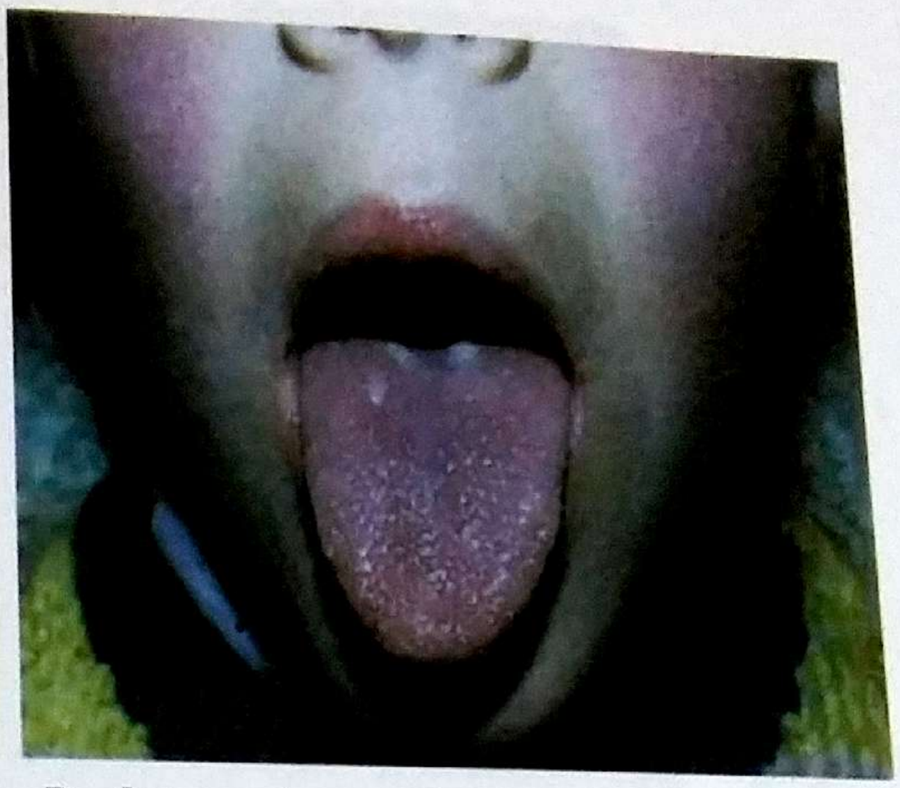
*Scrotal tongue (e.g.in Down syndrome)*



*Enlarged tongue (cretin)*



*White strawberry tongue ( coated with prominent papillae )*



*Red strawberry ( after disappearance of the white coat )*

## 6- Tonsils :

The tonsils normally have the same color as the buccal mucosa.

- Reddened tonsils covered with exudate indicate infection ( e.g. in streptococcal tonsillitis)
- A membrane covering the tonsils is seen in streptococcal tonsillitis, viral pharyngitis, infectious mononucleosis , and agranulocytosis.
- Observe movement of the uvula during examination of the tonsils. Deviation of the uvula or absence of movements may signal involvement of the glossopharyngeal or vagus nerve.

- In children with suspected epiglottitis , examination of the throat by tongue depressor is contraindicated to avoid suffocation.

- Observe movement of the uvula during examination of the tonsils. Deviation of the uvula or absence of movements may signal involvement of the glossopharyngeal or vagus nerve.

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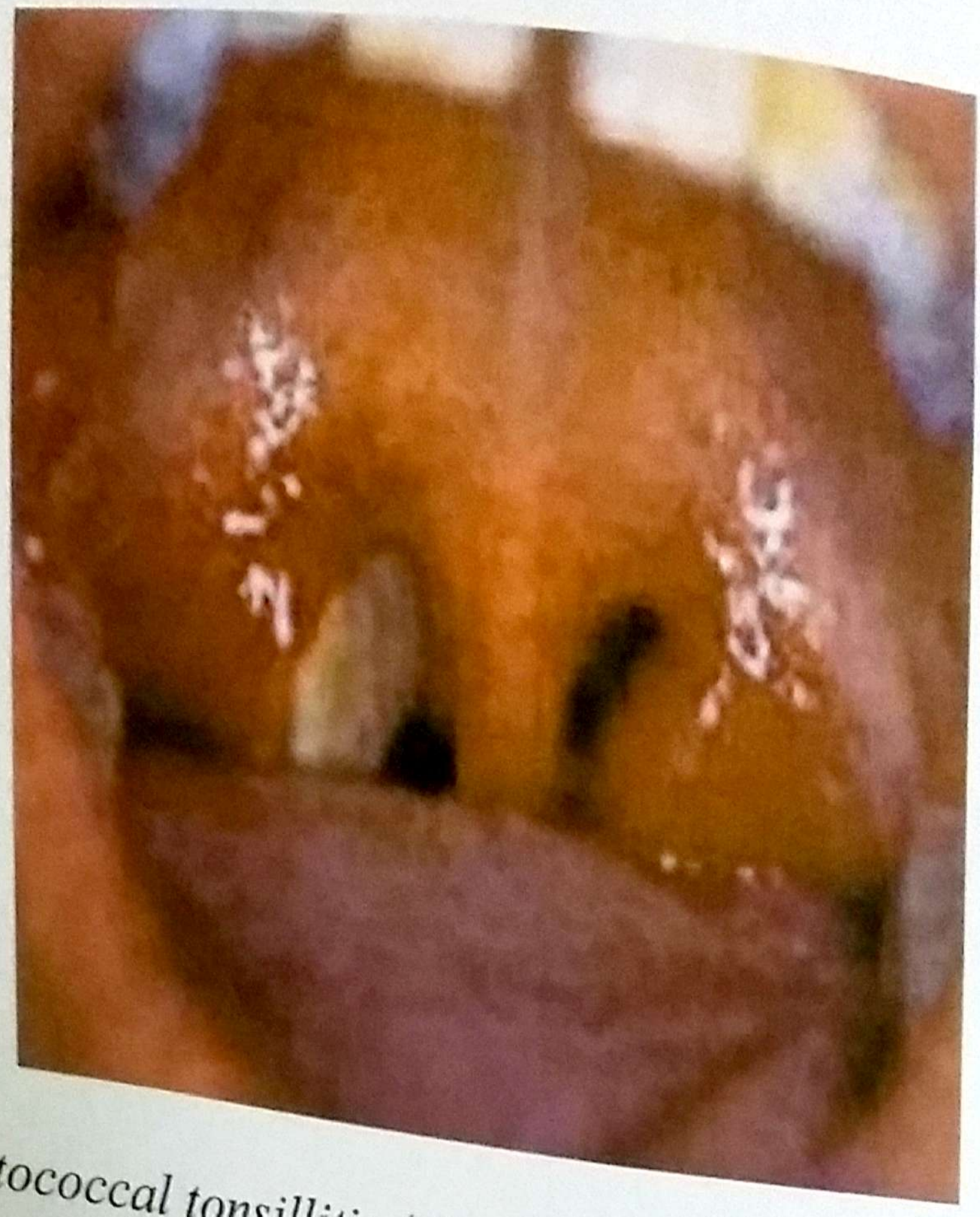
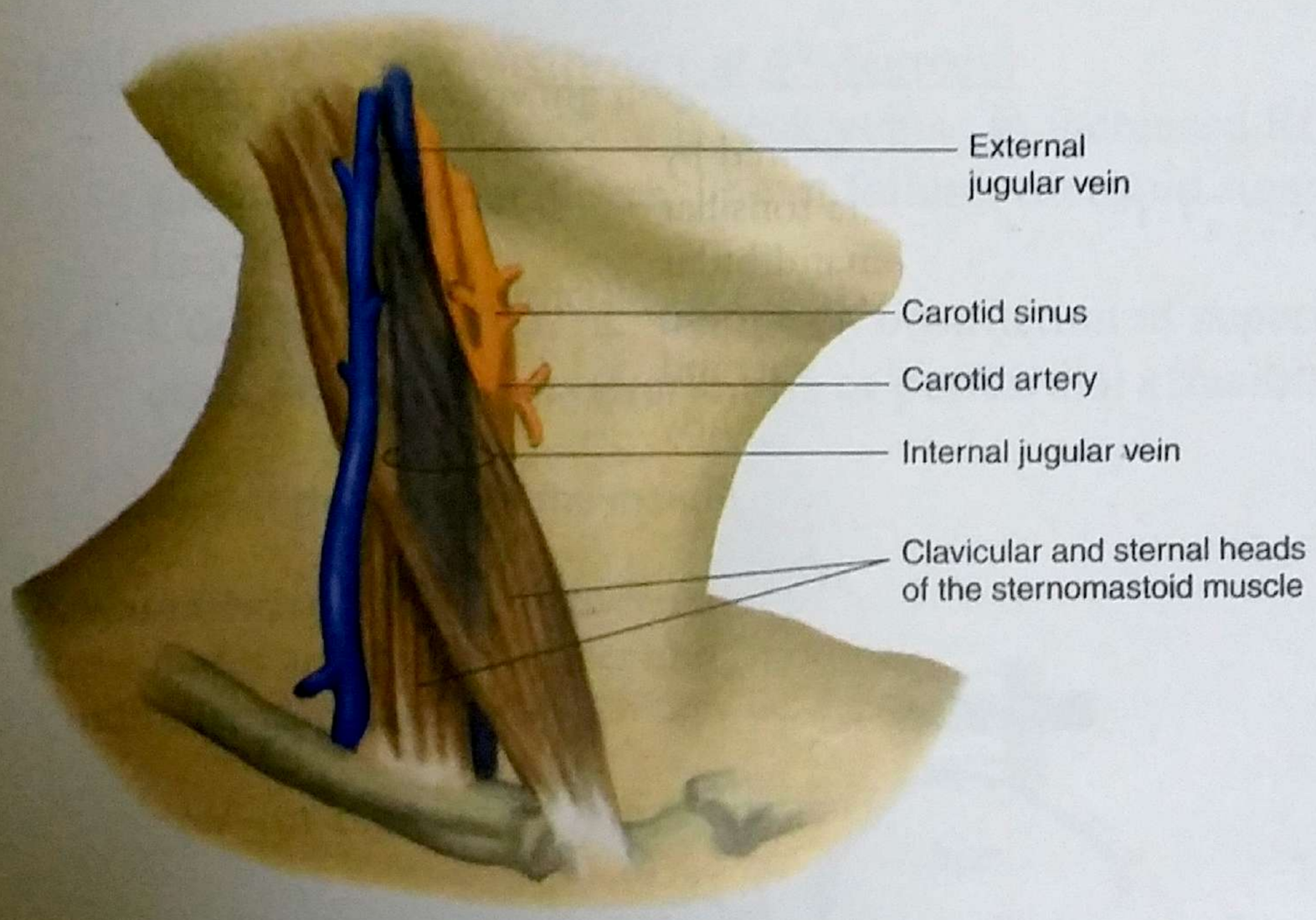


*Acute streptococcal tonsillitis ( the tonsils are red ,swollen,with membrane on the right tonsil, the anterior pillars are edematous)*

## F- Quality of voice :

- Nasal tone of voice : in enlarged adenoids.
- Hoarse cry or voice : in stridor , cretinism.
- High pitched cry : in increased IC pressure.
- Sound like cats : Cri du Chat syndrome .

# Neck Examination



# Neck Examination:

The neck should be examined for :

## 1- Short neck :

normal in the first 3-4 years
Cretinism

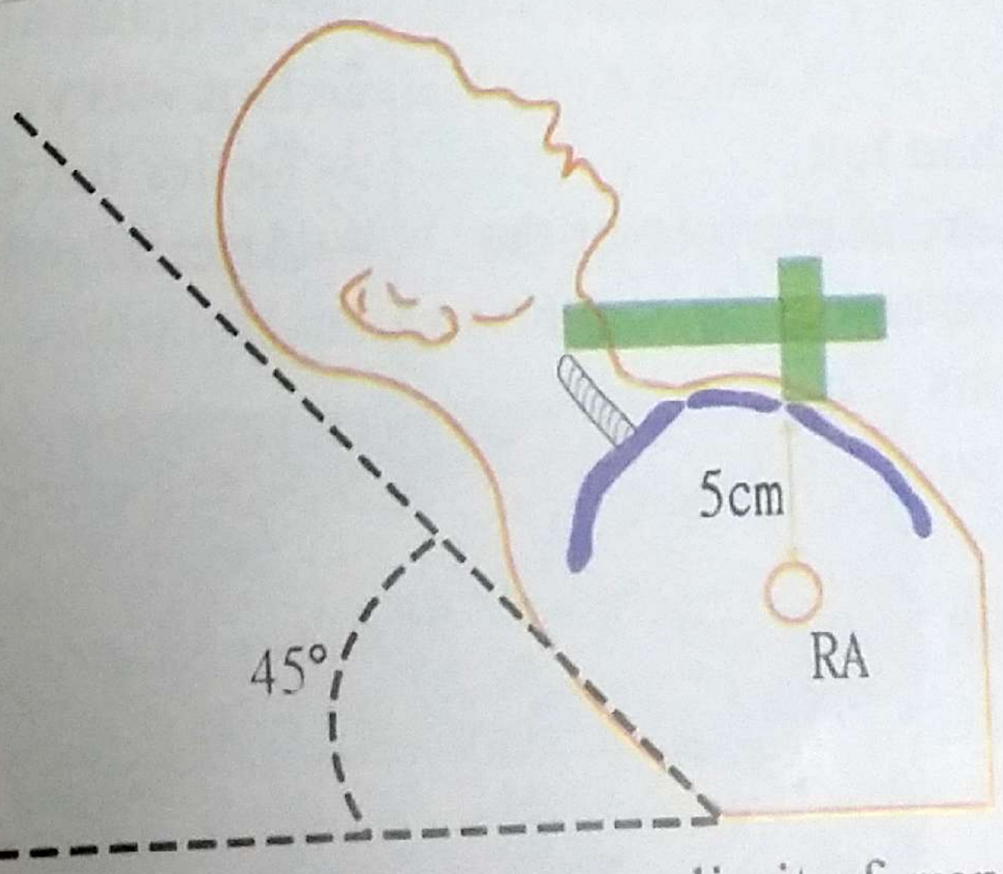
## 2- Vessels of the neck :

a- Neck veins : the patient must be supine at an angle of 45 to the horizontal. The neck must not be kinked and the patient must not strain, otherwise false congestion occurs. They are difficult to be examined in the neonates and infants due to their short fatty neck.

Neck veins reflect pressure changes in the right atrium as they are connected to it.

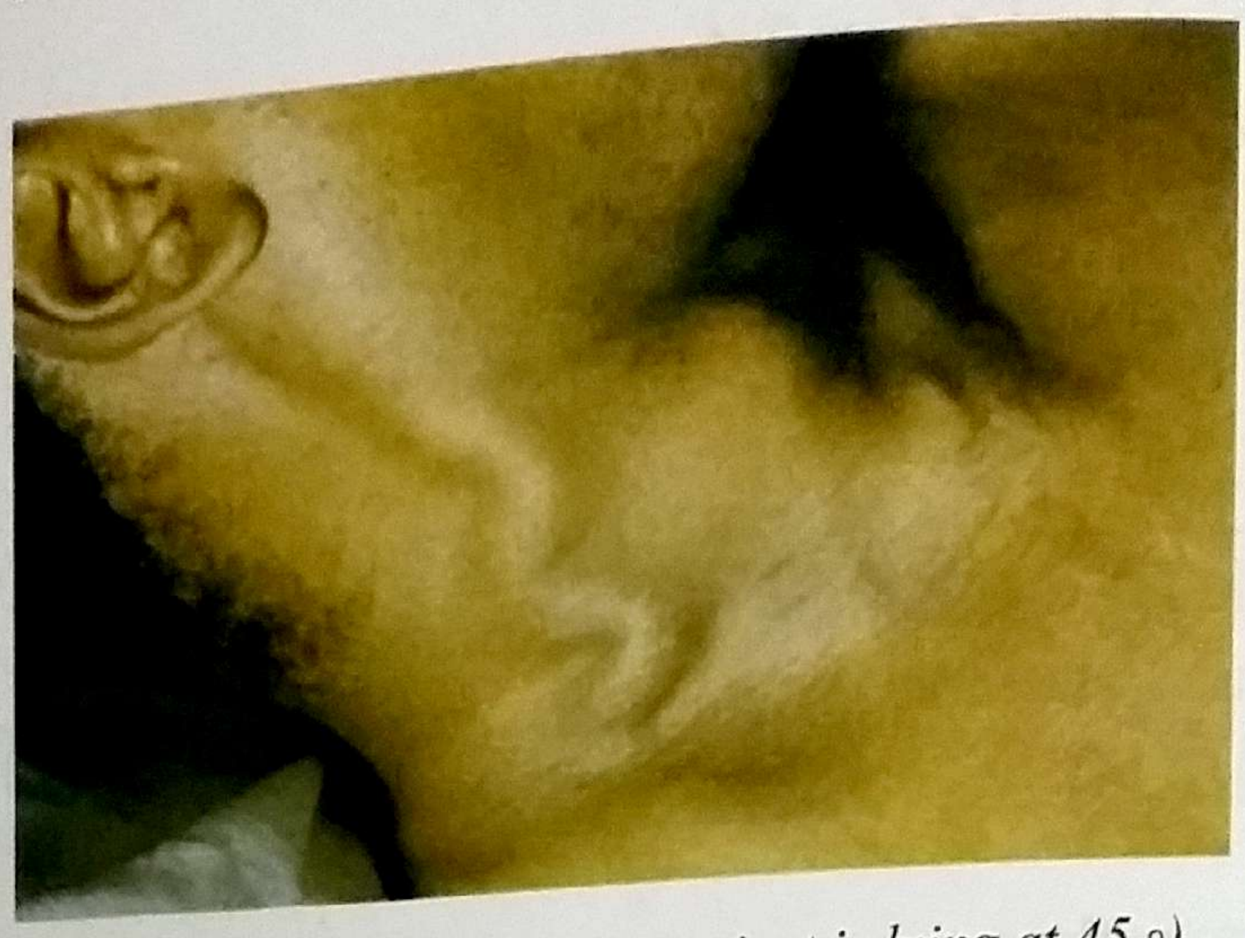
The Child should be semisitting ( at 45 degrees)

- Congested and pulsating neck veins : in increased Rt atrial pressure as in right sided heart failure, tricuspid stenosis or incompetence.
- Congested but not pulsating : in obstruction of superior vena cava , constrictive pericarditis or pericardial effusion.




Normally, reclining at 45◦ the upper limit of venous column is at the level of the clavicle . With increase in Rt atrial pressure the level of venous engorgement rises .

Abdomino-jugular reflux : Pressure with the examiner's hand firmly on the centre of the abdomen causes a transient rise in jugular venous pressure ( the external jugular veins will appear congested) due to increase in venous return to the heart . In cases of obstruction to the blood flow from neck veins to right atrium ( as in pericardial effusion or constrictive pericarditis ) → the reflux will be absent .



*Congested Neck veins ( the patient is lying at 45 °)*

## B- Neck arteries :

| Venous Pulsations | Arterial Pulsations |
|---|---|
| 1- Along the course of the external jugular vein lateral to the sternomastoid.<br>2- Wavy<br>3- better seen than felt.<br>4- Gentle pressure at the root of the neck→ increased congestion and abolish pulsations.<br>5- Affected by posture.<br>6- Emptying with inspiration | 1- Along the course of carotid artery ( or suprasternal) medial to the sternomastoid.<br>2- Not wavy .<br>3- Better felt than seen.<br>4- Arterial pulsations persist<br>5- Not affected by posture.<br>6- No relation to respiration. |

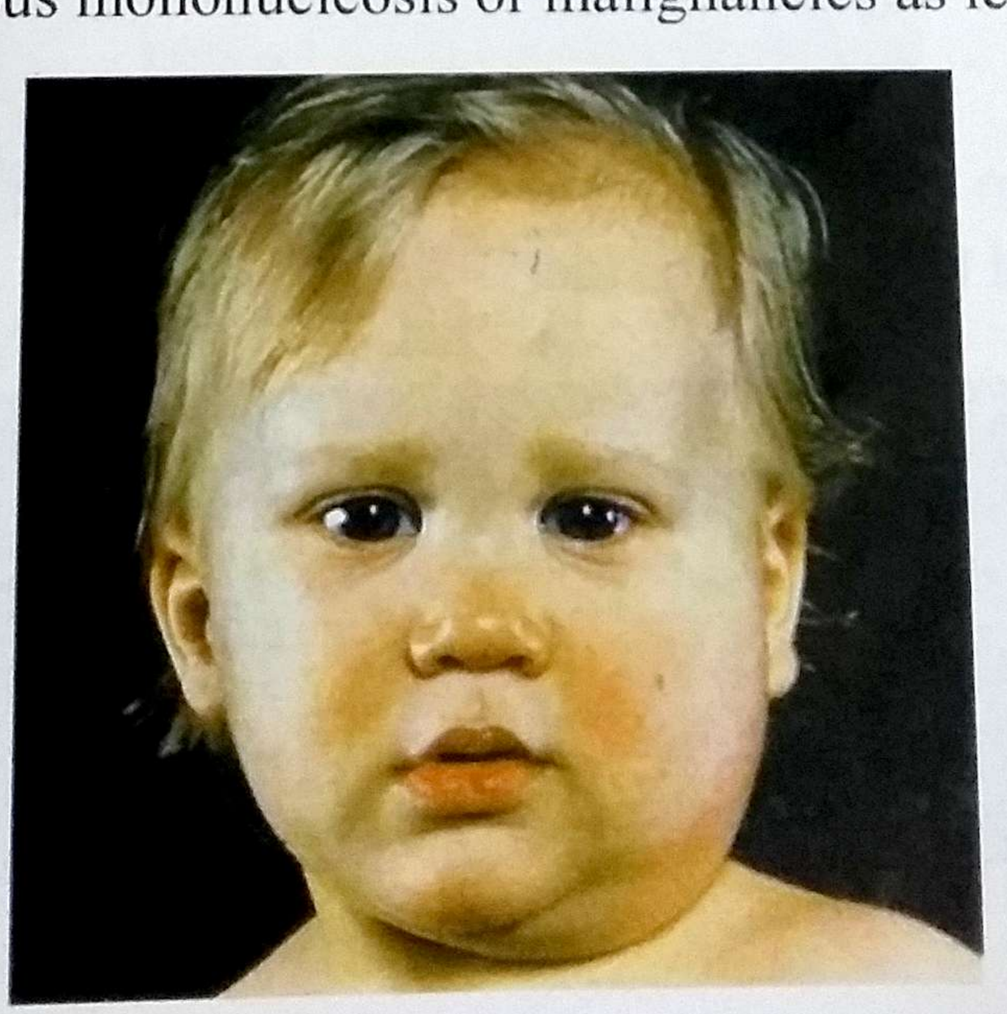
Examination of the arteries : may reveal :

- Corrigan Sign : vigorous carotid pulsations in aortic valve incompetence.
- Suprasternal pulsations :
  In hyperkinetic circulation as thyrotoxicosis, severe anemia or High aortic arch .
  Aneurysm of aortic arch
- Systolic thrill ( by palpating the artery): in aortic valve Stenosis.

3- Cervical Lymph nodes : see examination of lymph nodes.

*Enlarged cervical lymph nodes*

4- Parotid gland : enlarged in mumps, suppurative parotitis, other viral infections as infectious mononucleosis or malignancies as leukemia.



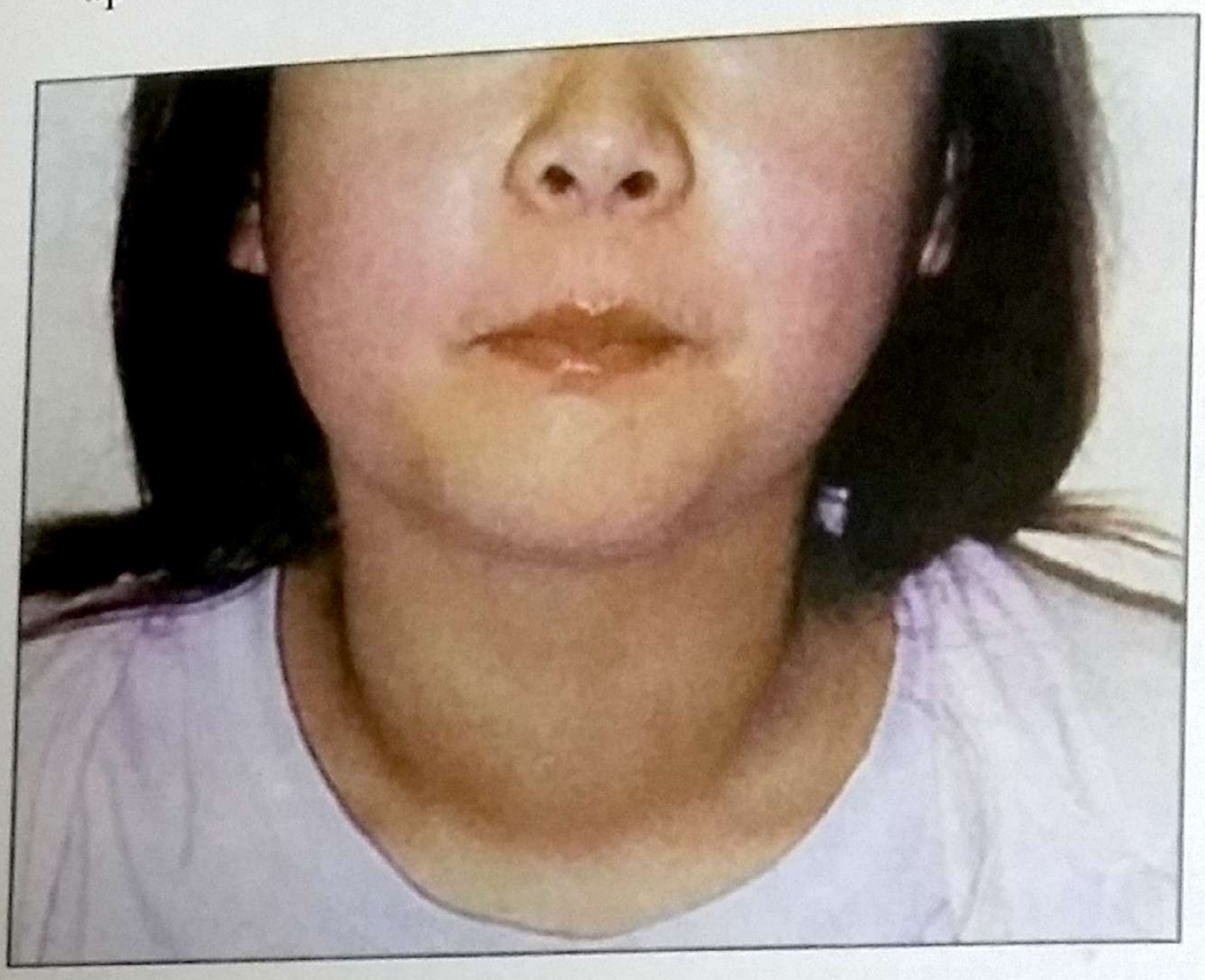
*Mumps*

5- Thyroid gland : enlarged thyroid is called GOITER

In infants : *with the patient lying supine , put your thumb on one side and the index and third fingers on the opposite side of the thyroid .*

In older children : *it is easier to palpate the thyroid from behind with two fingers of each hand on both sides of the thyroid cartilage .*

Also, enlarged thyroid can be detected by observing the neck while the patient is swallowing some water. It will move upwards during swallowing.



*Enlarged thyroid gland ( goiter)*

6- Neck Motion : ask the child to touch the chest with his chin and to turn the head from side to side.

Causes of Neck stiffness ( also called meningismus) :

- Meningitis
- Cerebral palsy
- Rheumatoid arthritis
- Cervical lymphadenitis
- Retropharyngeal abscess.
- Tetanus
- Upper lobar pneumonia
- Peritonsillar abscess.

# Extremities

# Extremities :

During infancy, the extremities appear relatively short. Until puberty, the rate of growth of extremities , particularly the lower ,exceeds that of the trunk. At puberty , the rate is about the same . The feet of infants are flat and the legs are bowed until walking has been established.

Examine the extremities for :

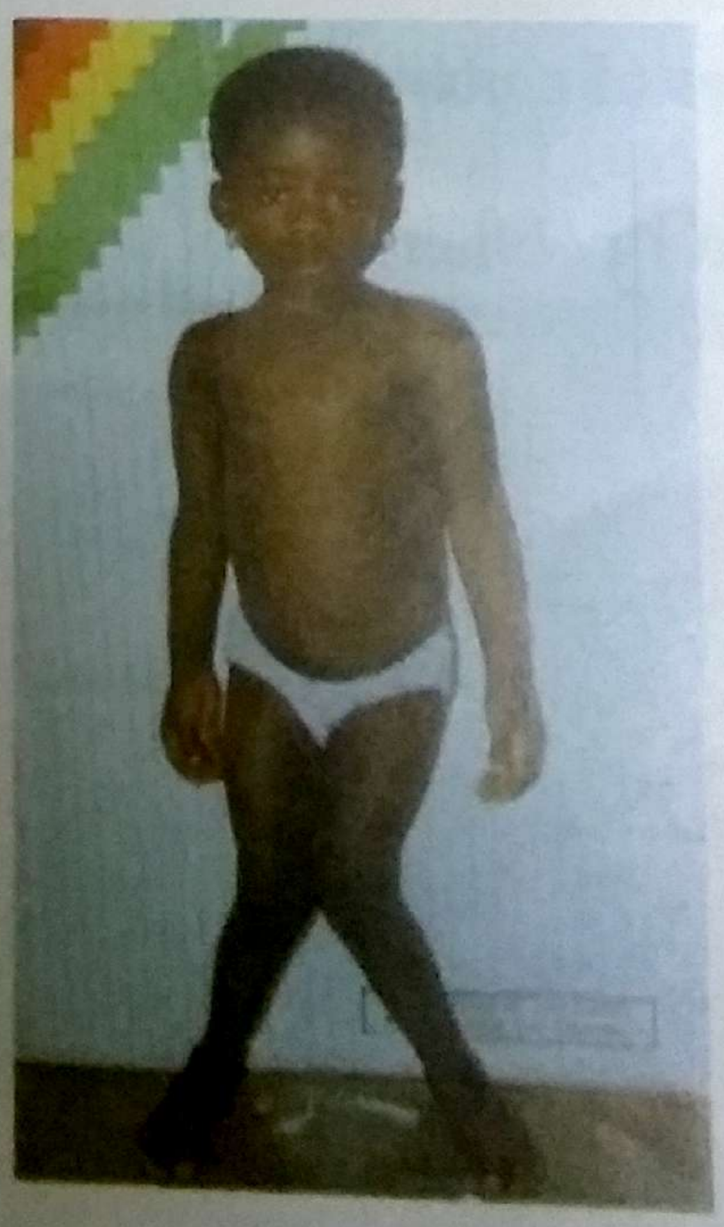
**1- Signs of Rickets :** should be routine in all infants.

- Epiphyseal enlargement at wrists and ankles.
- Bowing deformity ( genu varum).
- Marfan's sign : a transverse groove on medial and lateral malleoli.

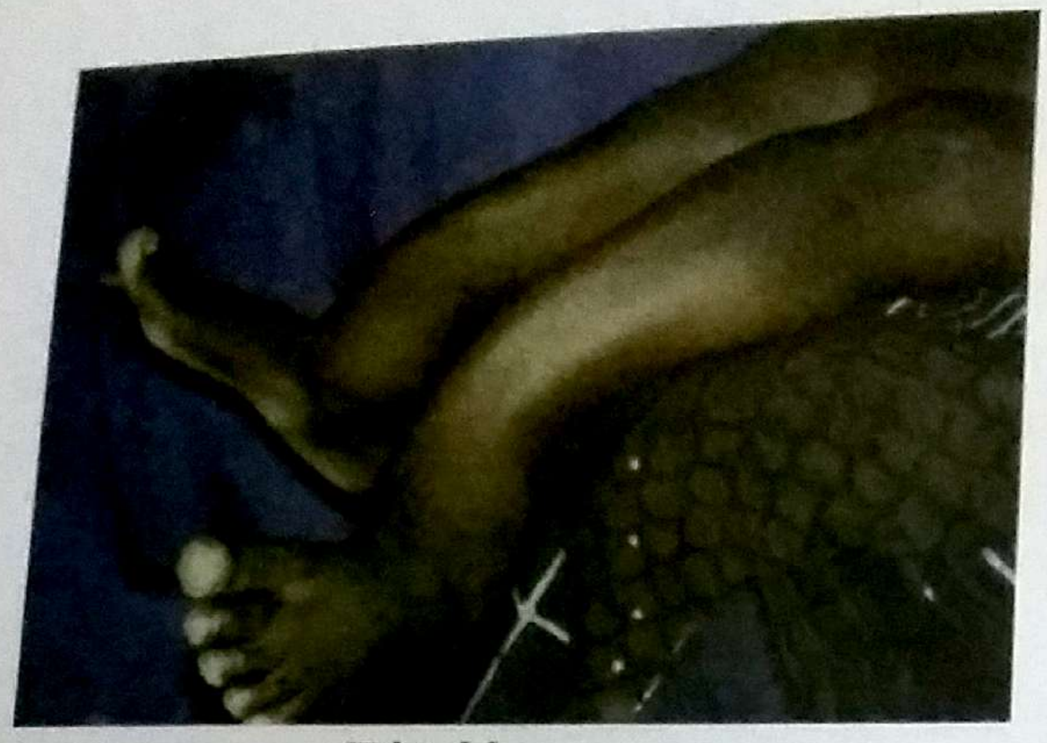
*Broadening of epiphyseal ends at Wrists*

*Broadening of epiphyseal ends at Ankles*

*Bow legs*



*Knock Knees*

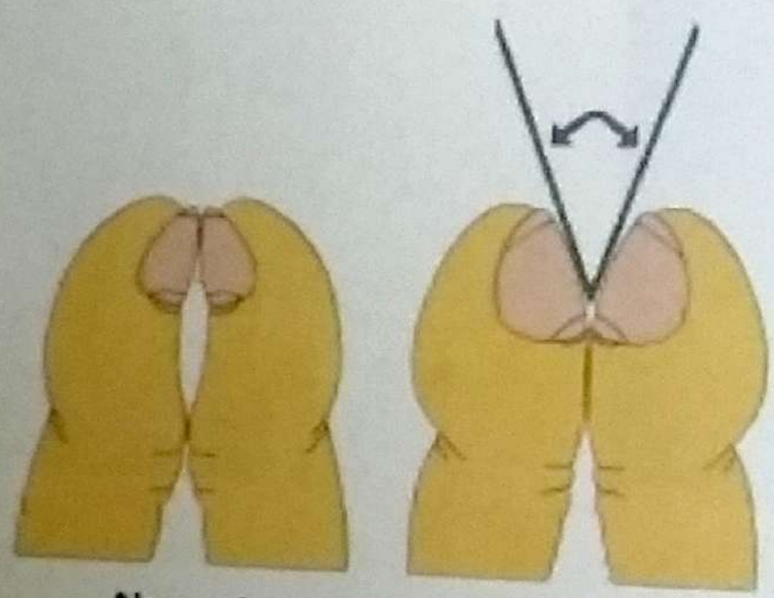


*Tibial bowing*

*Epiphyseal enlargement in rickets*

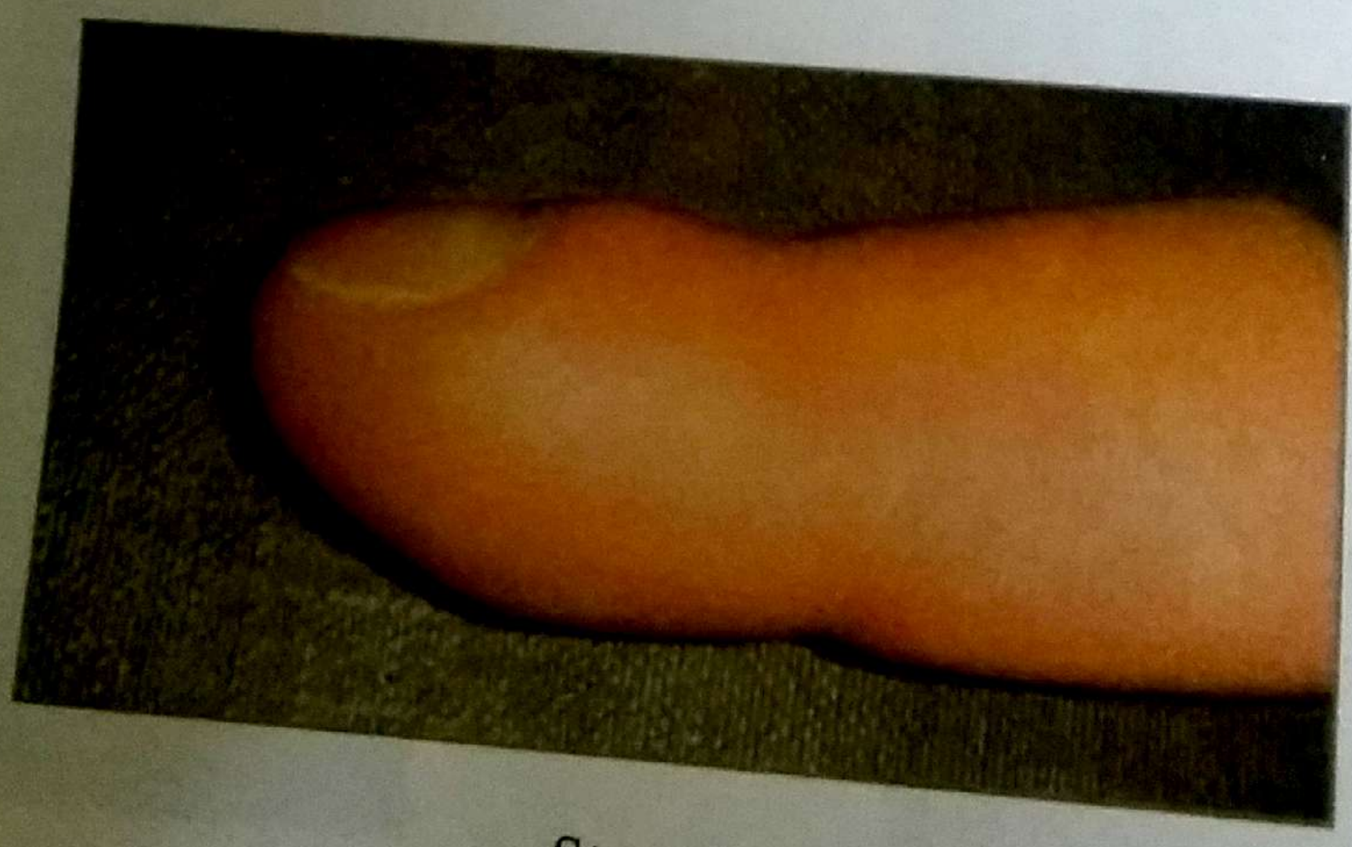
## 2- Clubbing of fingers :

Ask the child to oppose both thumb nails . Normally, a small diamond shape opening is visible. If there is clubbing, no space is seen .



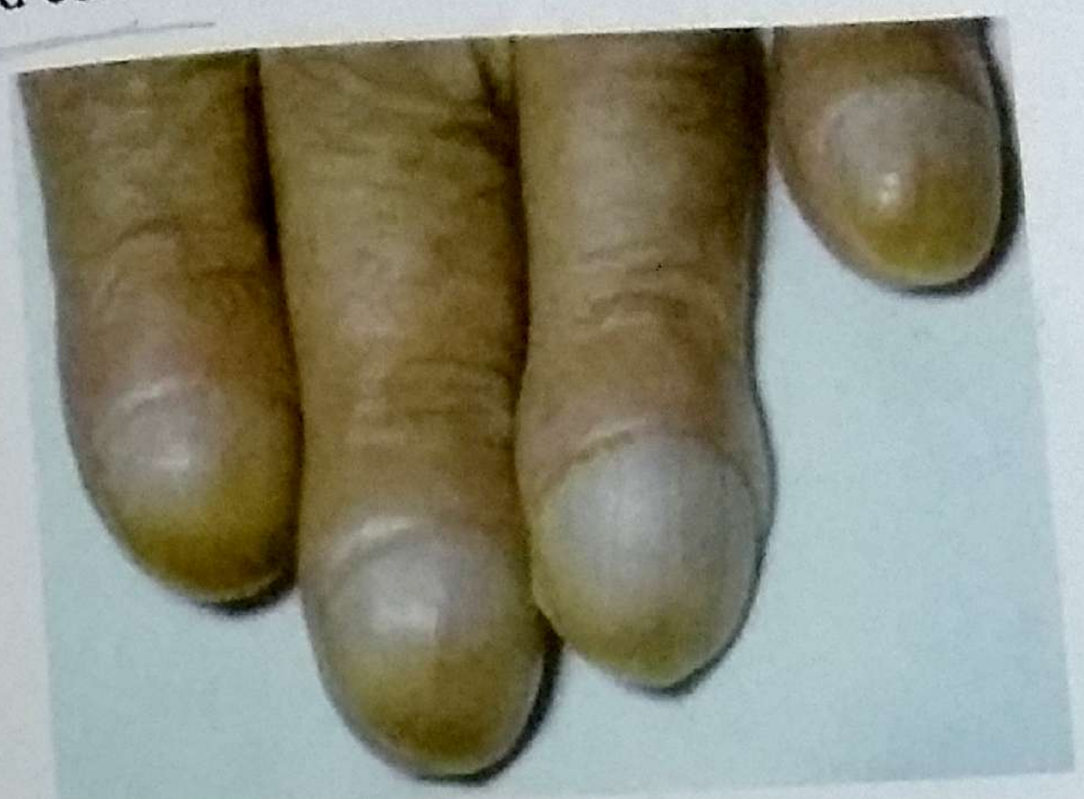

Stages of clubbing : 4 stages :

Stage 1 : obliteration of the angle and filling of the nail bed.

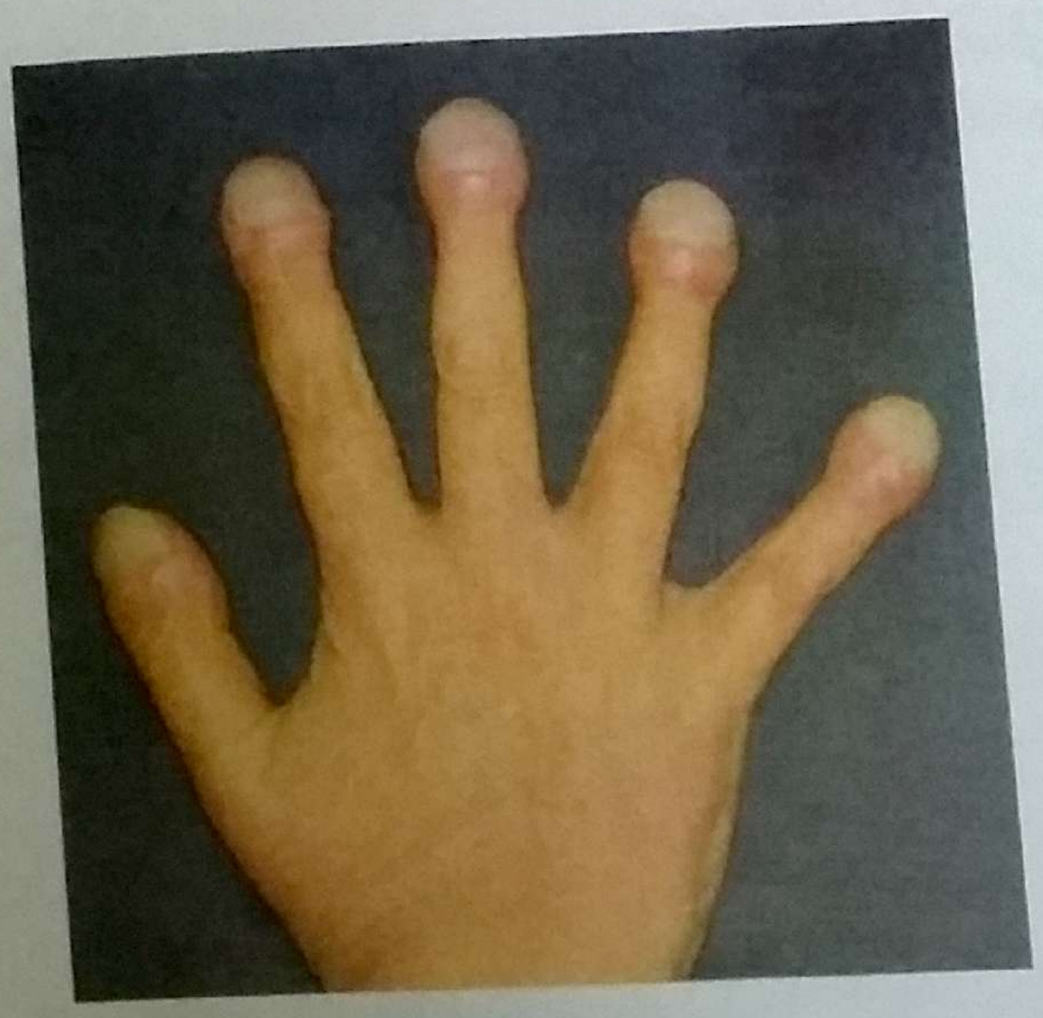


Stage I

Stage 2 : increased convexity of the nail leading to parrot peak appearance.



Stage 3 : Drum stick appearance ( increased bulk of soft tissue at the distal phalanges):



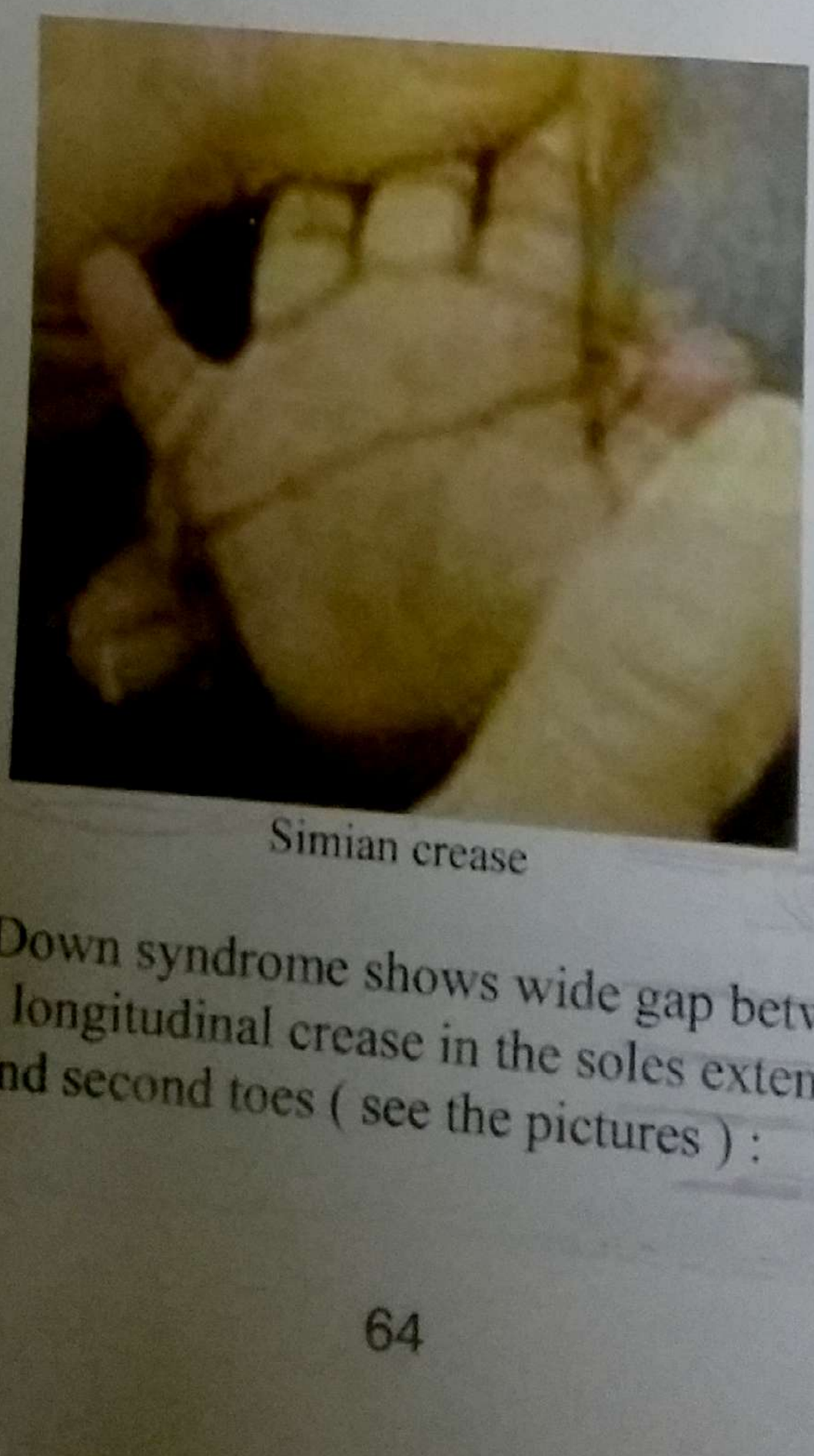
Stage 4 : pulmonary osteoarthropathy (as stage 3 swelling of distal end of radius & ulna).

| Causes of clubbing : |
| --- |
| 1- Cyanotic congenital heart disease<br>2- Chronic suppurative lung diseases as bronchiectasis , empyema , and lung abscess.<br>3- Chronic liver disease as cirrhosis.<br>4- Infective endocarditis.<br>5- Intestinal polyposis .<br>6- Cystic fibrosis.<br>7- Uncommonly, familial. |

3- **Carpopedal Spasm due to Tetany :** especially in rachitic infants

*Picture of carpopedal spasm due to hypocalcemia , note the extension of interphalengeal joints and flexion of metacarpophalengeal joints and flexion of wrist joints*

4- In **Down syndrome** there is short fingers , may be incurved little fingers (clinodactyly) and a single palmer crease ( simian crease).



Simian crease

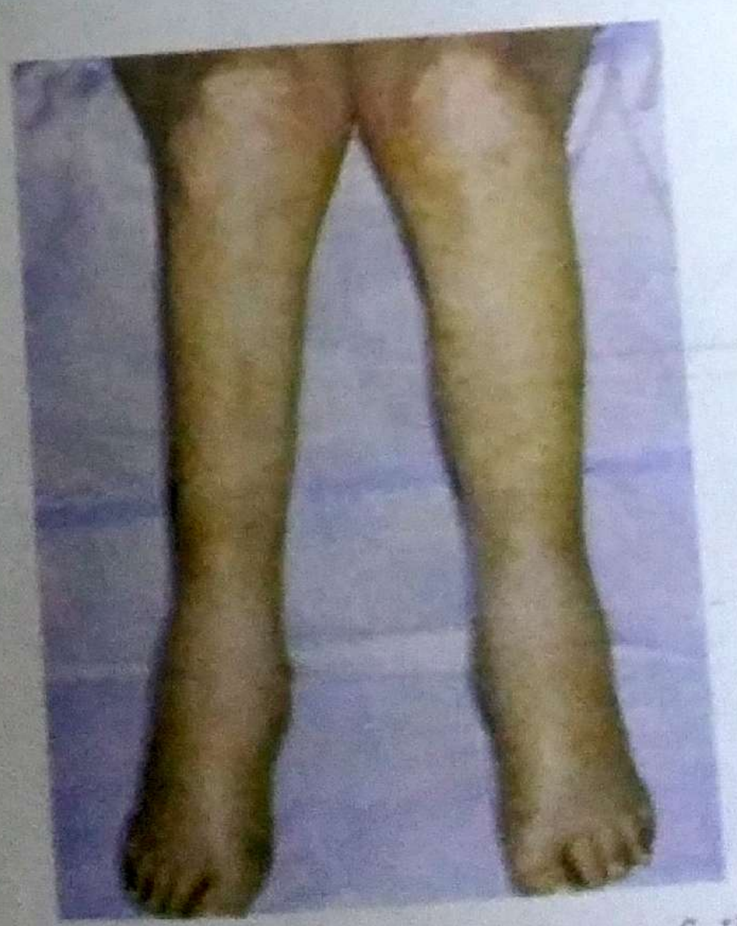
The feet in Down syndrome shows wide gap between the first and second toes with a longitudinal crease in the soles extending from the space between the first and second toes ( see the pictures ) :

*A wide distance between big and second toes with a longitudinal groove in the soles*

5- In **Marasmus** : the extremities appear stick like due to severe muscle wasting and loss of subcutaneous fat.

*Very thin extremities in Marasmus due to Severe muscle wasting and loss of SC fat*

6- **Edema :**



*Edema of both L.L. in heart failure*

*Edema in Kwashiorkor, note dermatosis*

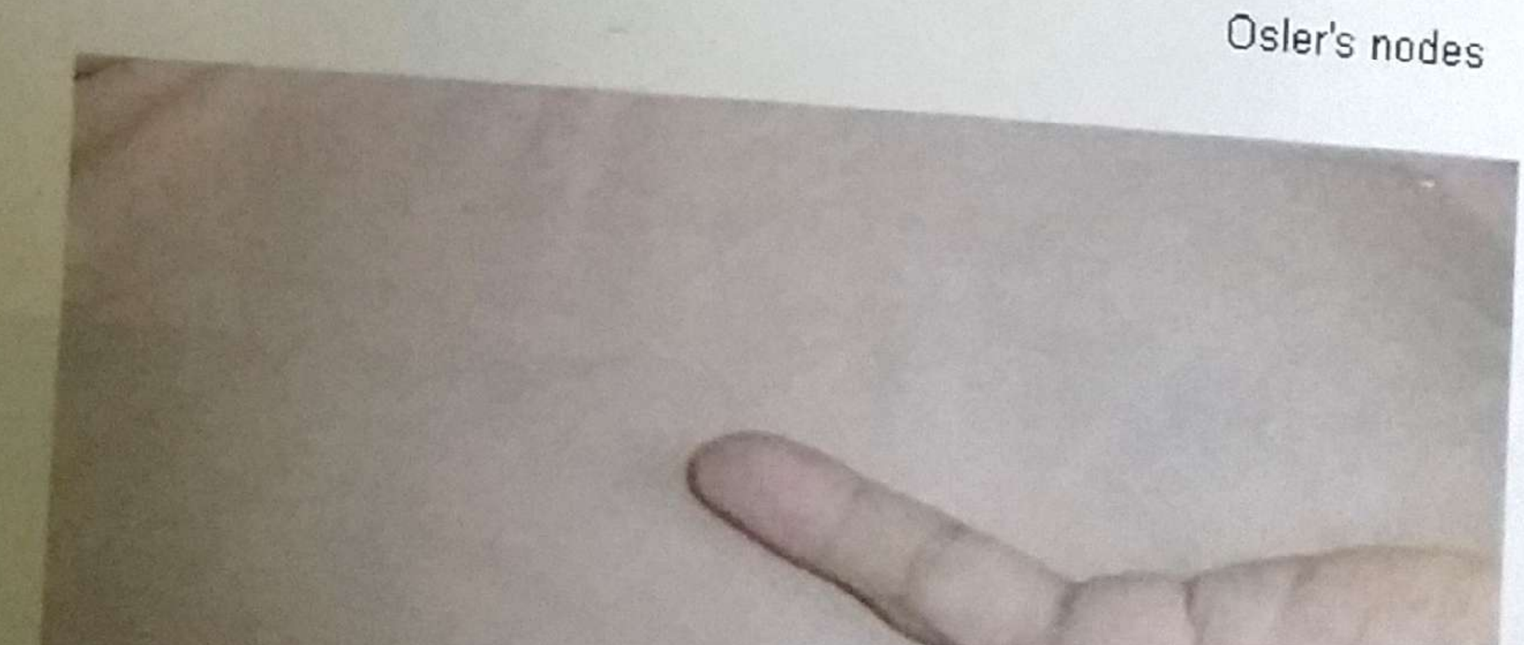
Edema is caused by excess fluid in the subcutaneous tissue . To check for pitting edema, press firmly but gently with the ball of the thumb for 30 seconds (1) over the dorsum of each foot , (2) over the medial malleolus of the tibia on both sides , and (3) over the shins . Look for pitting ( a depression caused by pressure from your thumb) . Normally , there is none .

| Causes of generalized edema : | Causes of localized edema: |
|---|---|
| - Nutritional as in Kwashiorkor<br>- Renal as in Nephrotic syndrome<br>- Cardiac : congestive heart failure.<br>- Fulminant hepatic failure.<br>-Cirrhosis. | - Allergy as in angioneurotic edema.<br>- Local inflammation. |

7- In **infective Endocarditis** : Osler's nodes and splinter hemorrhages in addition to clubbing are seen in subacute bacterial endocarditis.

Splinter Hemorrhages

Osler's nodes



Osler's node in the hand

**Osler's nodes** :are small, tender, erythematous ,transient skin lesions characteristic of bacterial endocarditis. They are present in the pads of the fingers or toes ,and in the palms of the hands or soles of feet , they are due to infected emboli.

**Splinter hemorrhages** : longitudinal red lines resembling small splinters under the nails. They are due to hemorrhage from capillaries.

## 8- Joints :

Joint problems in children are either primary or secondary . A Common primary arthropathy in childhood is Juvenile chronic arthritis.Joints are also involved in septic arthritis, trauma , malignancy . Systemic problems may present with arthropathy as rheumatic fever , collagen vascular diseases , leukemias and septicemia.

To examine the joint ( usually a limb ) in question, expose the arm or leg. You will look, feel and move the joint that you are examining.

**Inspection of joints** : swelling , redness, muscle bulk , abnormal position of the joint , any subcutaneous nodules.

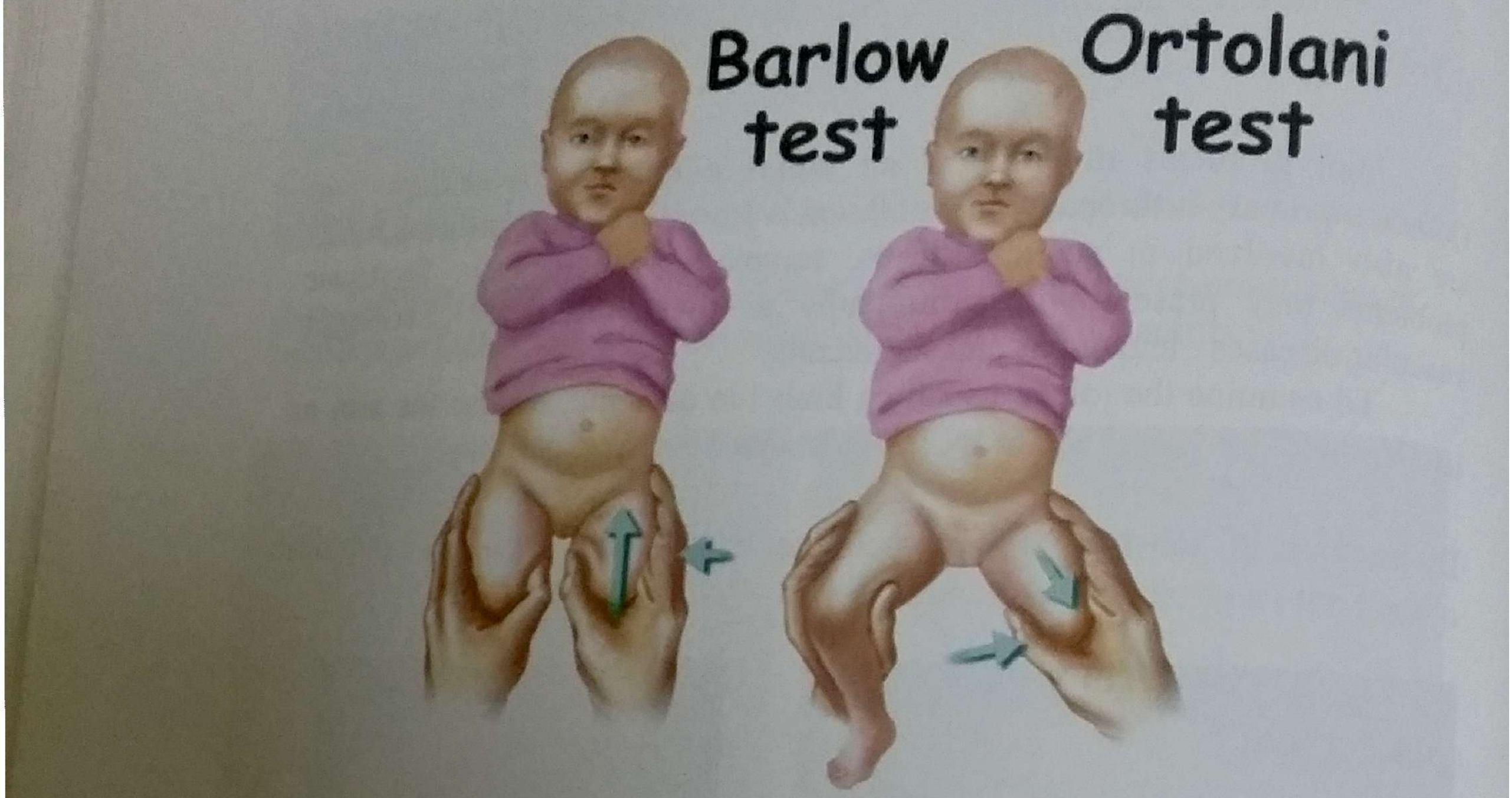
*Swollen Knee joint*

*Swollen interphalengeal joints*

**Palpation of the joints** : Palpate the joint of the affected side as well as the joint on the opposite side : examine for tenderness , hotness , movement of the joint .

## 9- Ortolani Test and Barlow test :

The newborn hips should be routinely examined for congenital hip dislocation by Ortolani test ( test for presence of dislocated hip ) and Barlow test ( for intact but unstable hip). The baby should be relaxed for the 2 tests.

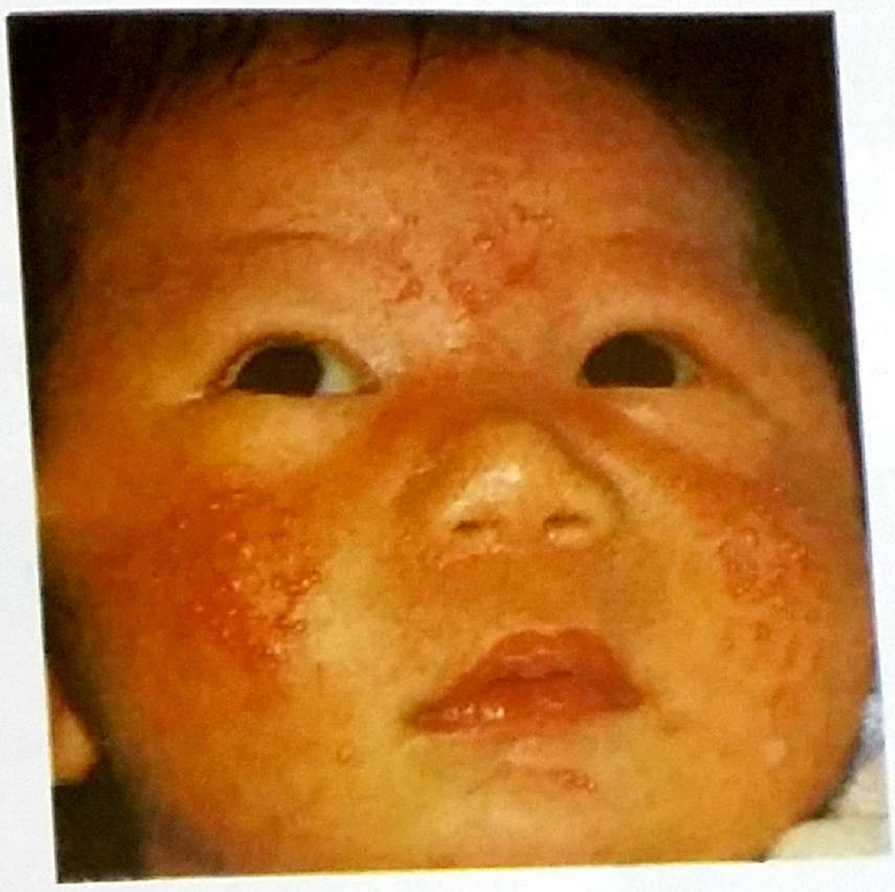



**Ortolani test :** place the baby supine with the legs pointing toward you. Flex the legs to form right angles at the hips and knees, placing your index fingers over the greater trochanters of each femur and your thumbs over the lesser trochanters .

Abduct both hips simultaneously until the lateral aspect of each knee touches the examining table →In hip dislocation, you feel a "clunk" as the dislocated femur head, which lies posterior to the acetabulum , enters the acetabulum = Positive Ortolani test

**Barlow test :** Place your hands in the same position as Ortolani test. This time press in the opposite direction with your thumbs moving down toward the table and outward . Feel for any lateral movement of the femur head. Normally, there is no movement and the hips feel stable.

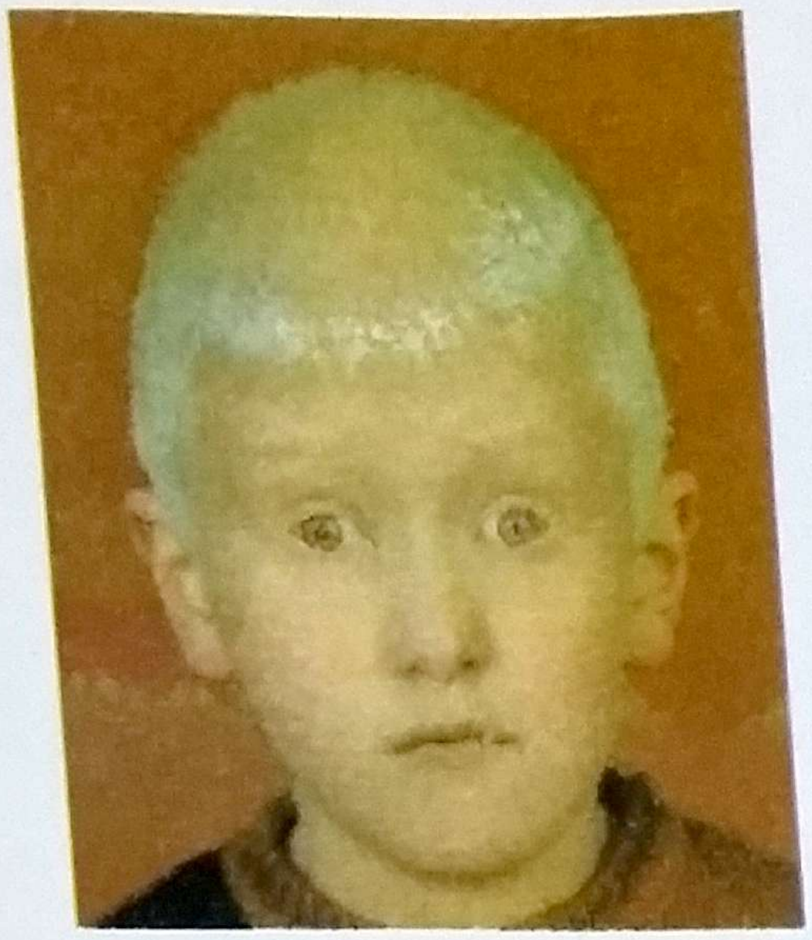
# Skin Examination



# Skin Examination :

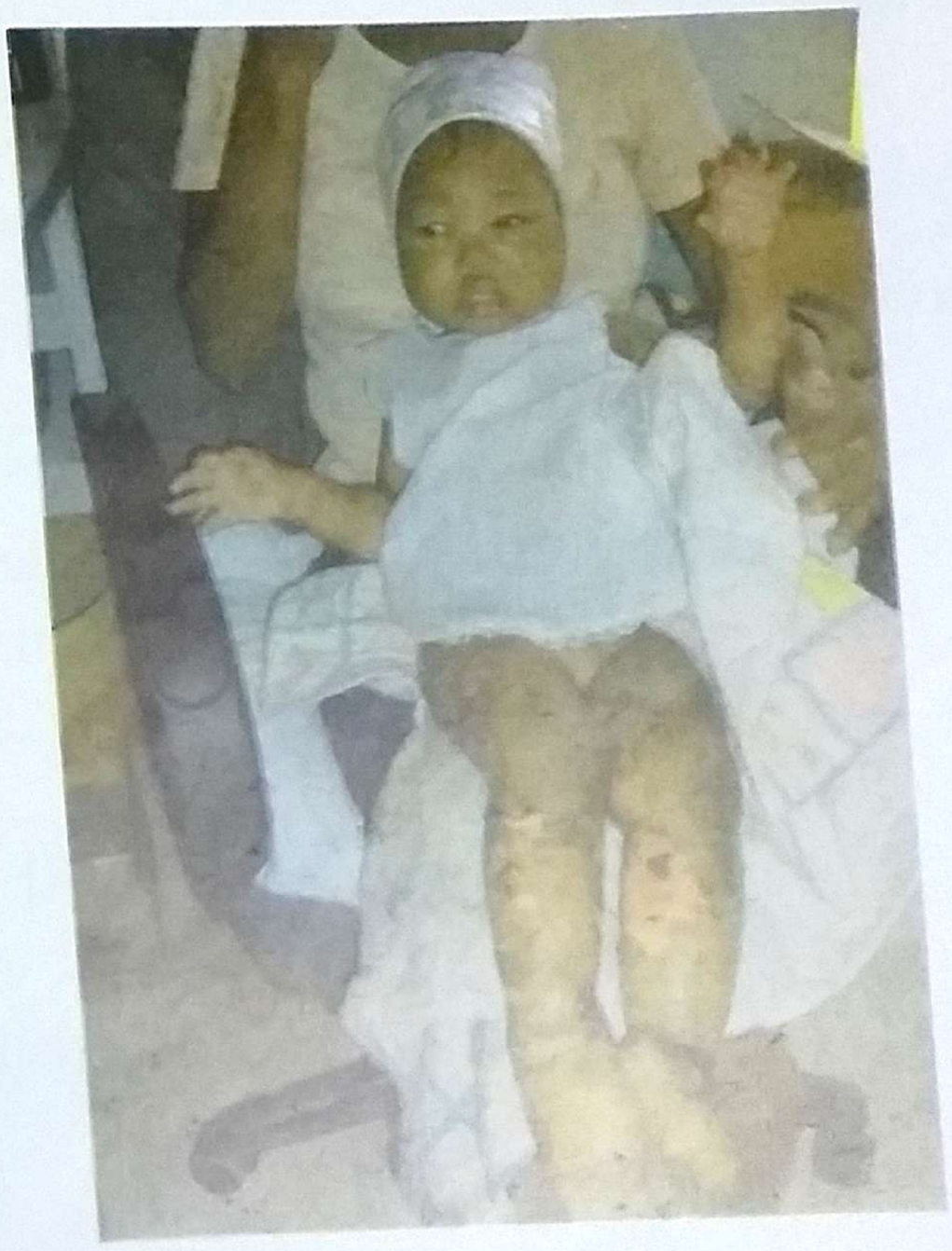
## 1) Skin pigmentation :

Hypopigmentation : in albinism



Hyperpigmentation e.g.

-Dermatosis of Kwashiorkor:

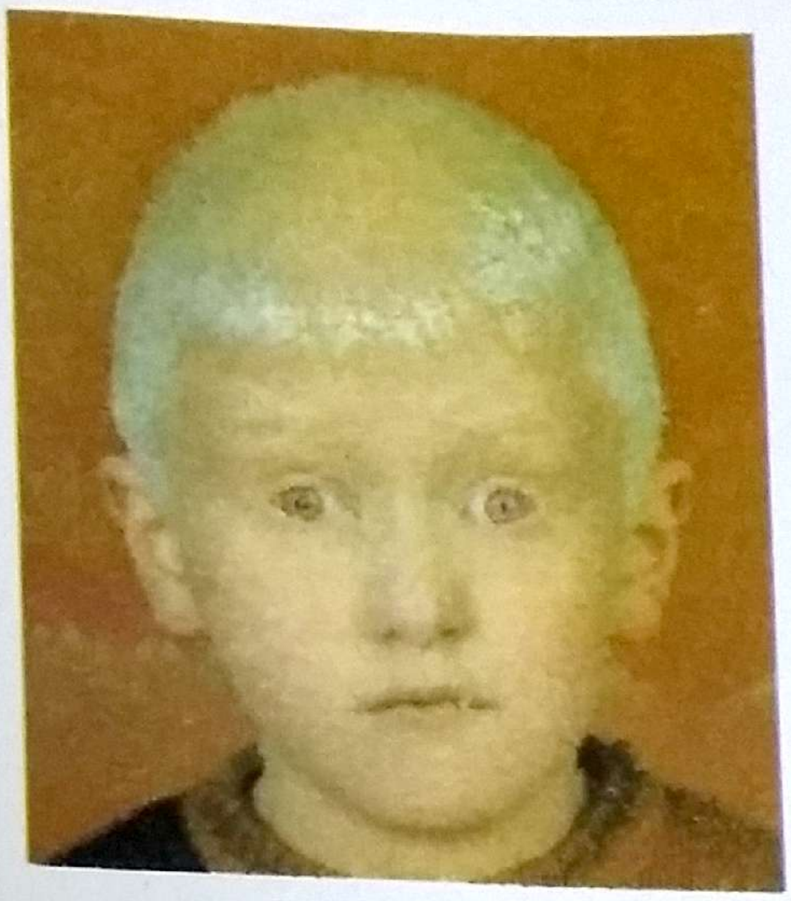


*Dermatosis in kwashiorkor : hyperpigmented areas that desquamate leaving hypopigmented areas. In severe cases , it may resemble burn ( weeping dermatosis).*

# Skin Examination :

## 1) Skin pigmentation :

Hypopigmentation : in albinism



Hyperpigmentation e.g.

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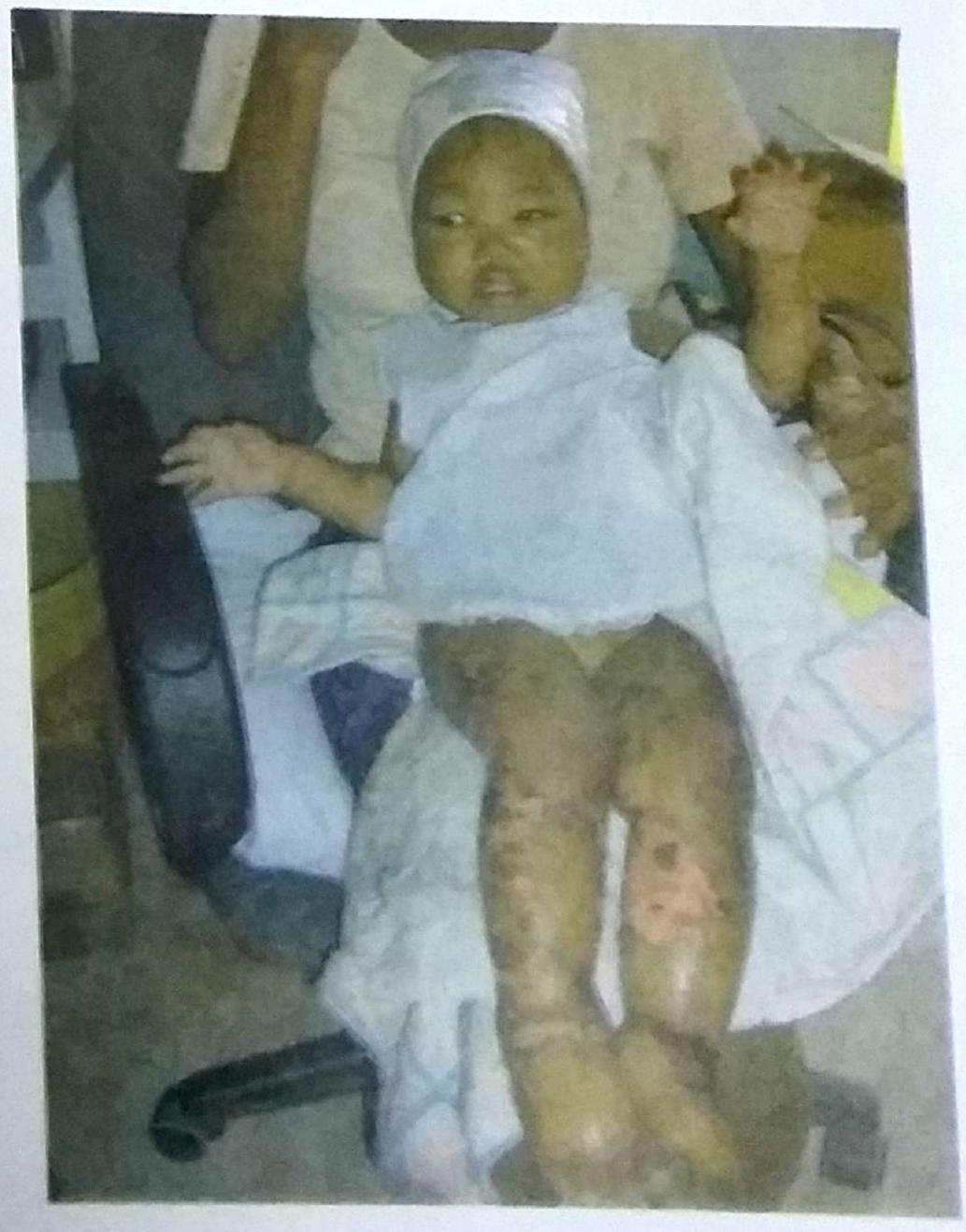


*Dermatosis in kwashiorkor : hyperpigmented areas that desquamate leaving hypopigmented areas. In severe cases , it may resemble burn ( weeping dermatosis).*

-Hemosiderosis
-Addison's disease

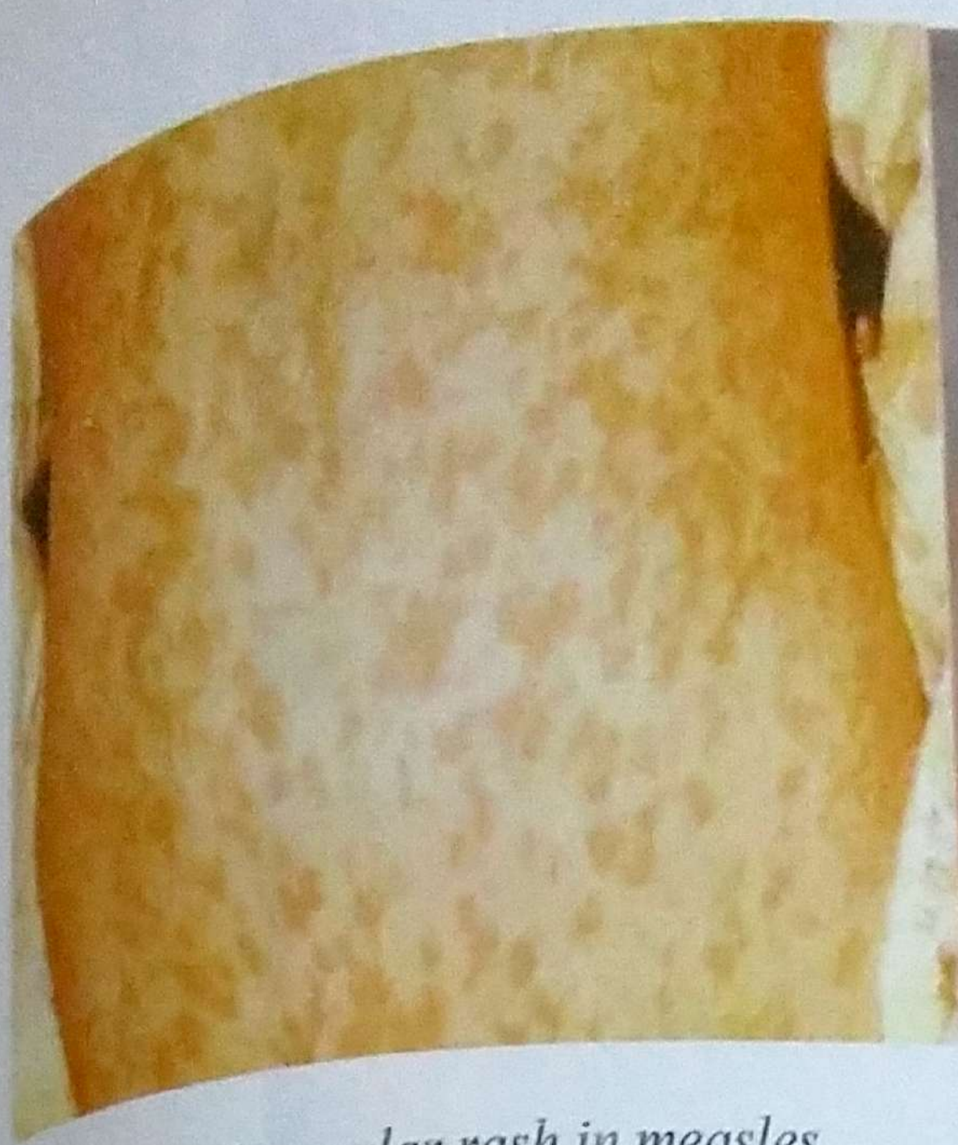
Mongolian spots : irregular areas of blue pigmentation caused by increased melanin , usually present in lumbosacral and gluteal region, but may be present at any area of the body . They disappear after few years and have no pathological significance.

*Mongolian spots*

2) Skin rashes : In examination of skin rash , the examiner should comment on : shape ,color, distribution, and if fades on pressure or not .

A) Maculopapular rashes :-

*Viral* : measles , german measles, roseola infantum, erythema infectiousum , Infectious mononucleosis, and enteroviruses.
*Bacterial :* scarlet fever , meningococcemia , and typhoid fever.
*Fungal :* tinea .
*Collagen diseases* : SLE , rheumatic fever or rheumatoid arthritis.
*Allergic :* insect bite, serum sickness and drug rash.



*Maculopapular rash in measles*

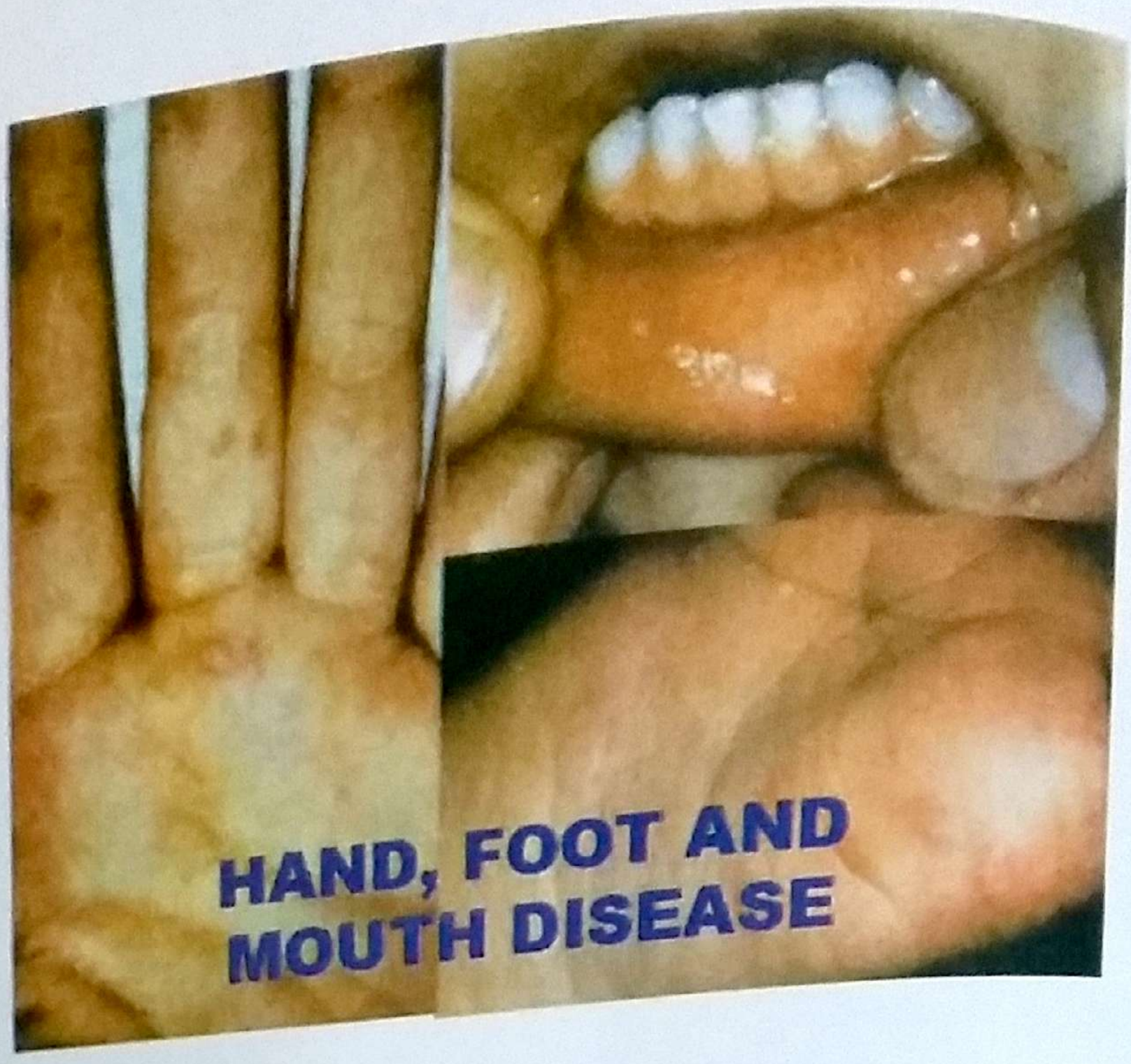
*MP rash in infectious mononucleosis*

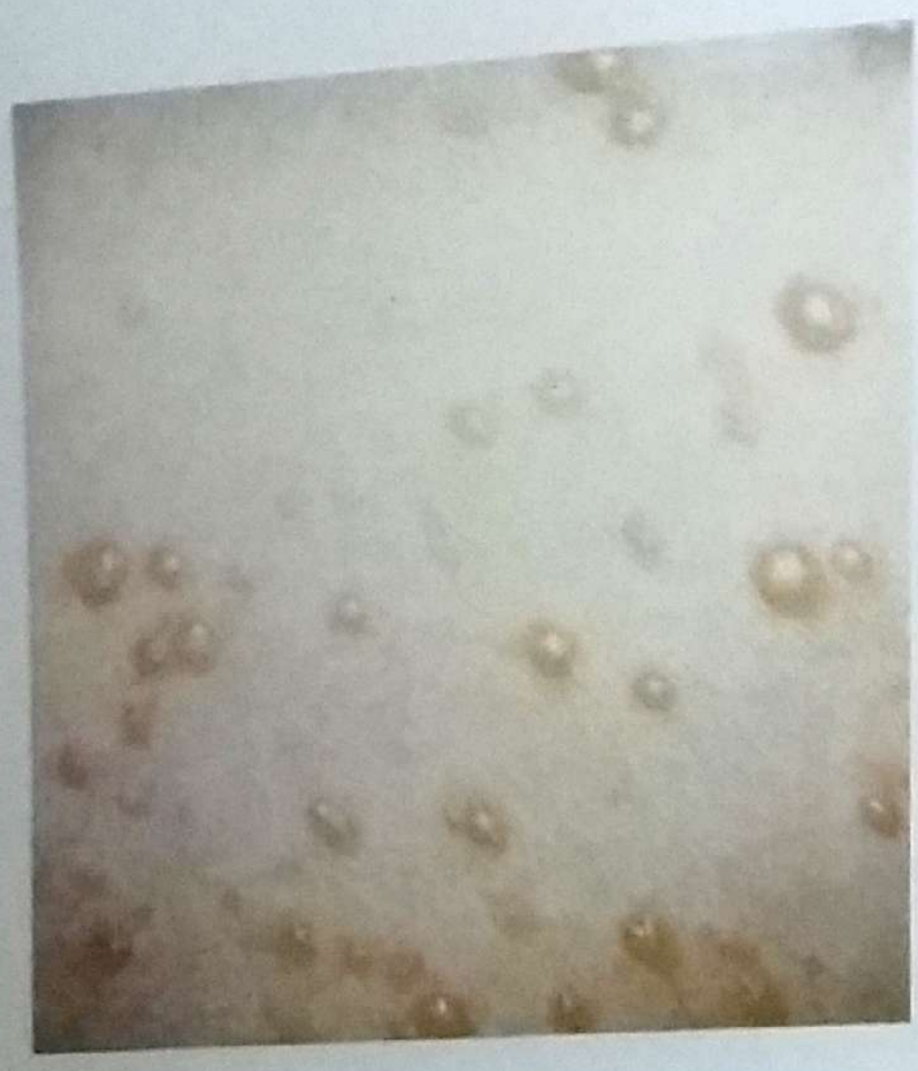
*MP rash in rubella*

*MP rash in roseola infantum*

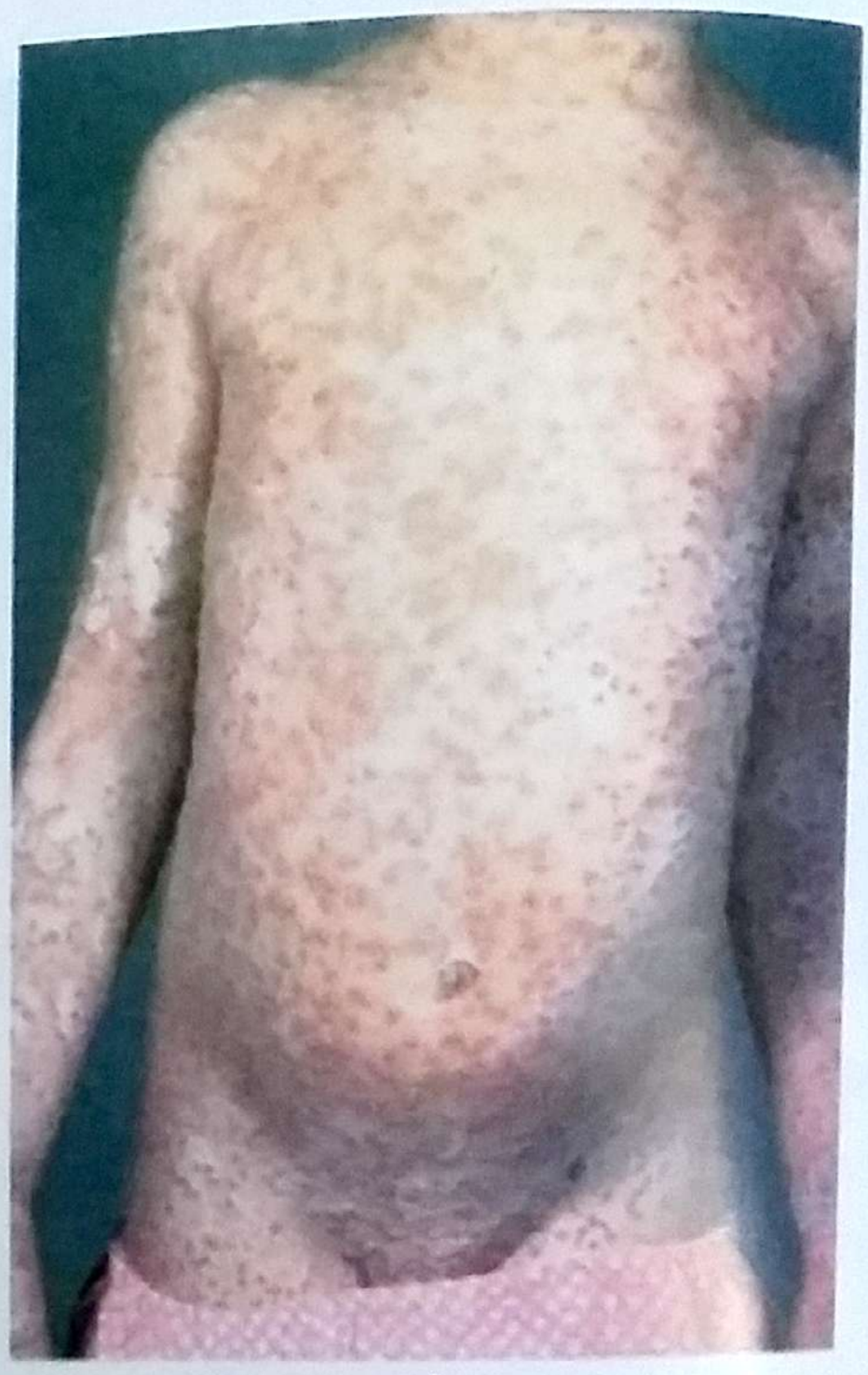
## B) Papulovesicular rashes :

Viral : chicken pox.
Herpes simplex.
Enteroviruses : in hand foot mouth disease.
Bacterial as impetigo.
Insect bite : papulovesicular urticaria .



*Close view of varicella vesicles*



*Severe varicella* .

C) Erythema marginatum in rheumatic fever : Starts as macules that clear in the centers leaving erythematous margins .

Erythema marginatum : the macules clear in the centre while the margins are erythematous

## D) Petechiae and purpura :

Causes :

1- Thrombocytopenic purpura : ITP, acute leukemia, aplastic anemia , hypersplenism , collagen vascular disease as SLE.

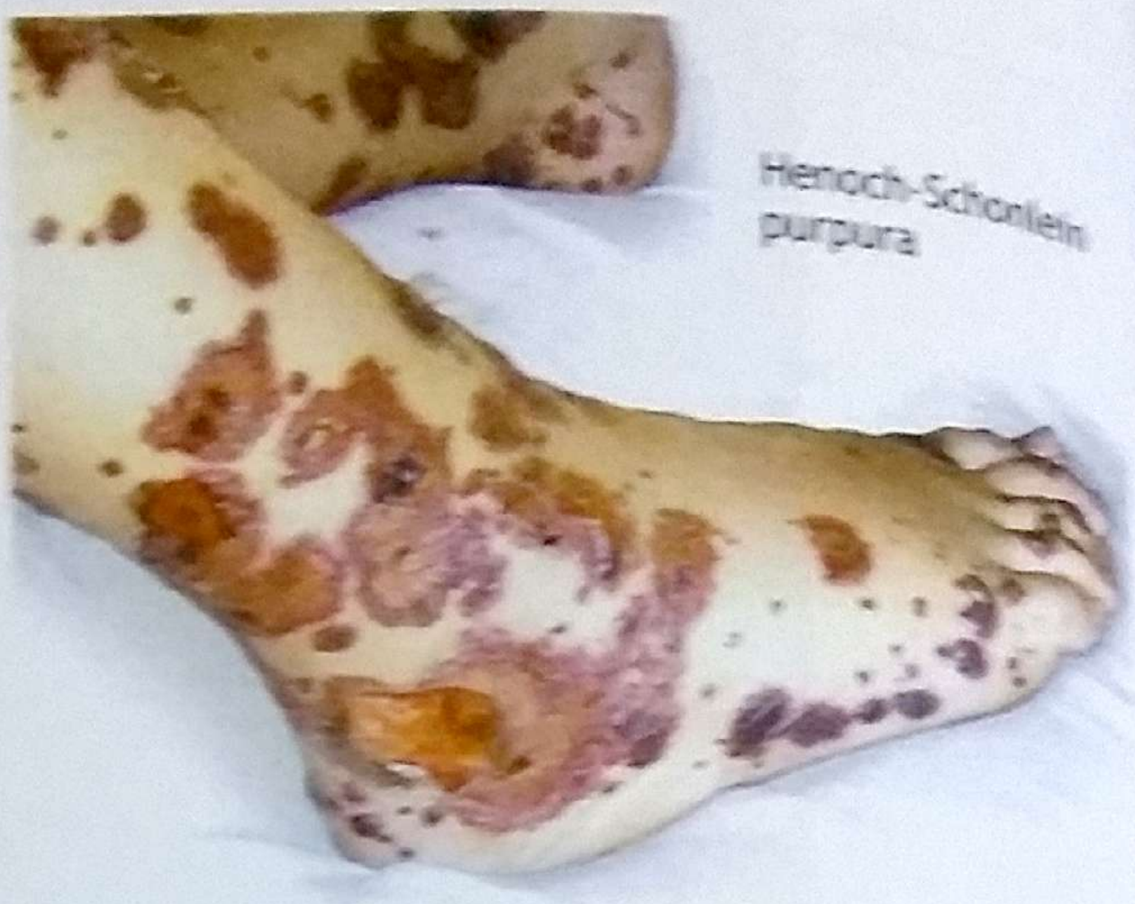
2- Non thrombocytopenic purpura :

i- Disorders of platelet functions : congenital or acquired ( as in chronic renal failure).

ii- Vascular disorders : As Henoch-Schonlein purpura, meningococcal septicemia, infective endocarditis , whooping cough ,severe PEM, Vitamin C deficiency .

**Petechiae** : purple spots due to capillary hemorrhage in the dermis of skin, they are not raised and do not fade on pressure. If the spots are large in size , they are called **Purpura** which may be very severe affecting extensive areas of skin **(Purpura fulminans)**.See the following pictures.

Petechiae in ITP




Purpura in Henoch Schonlein Purpura

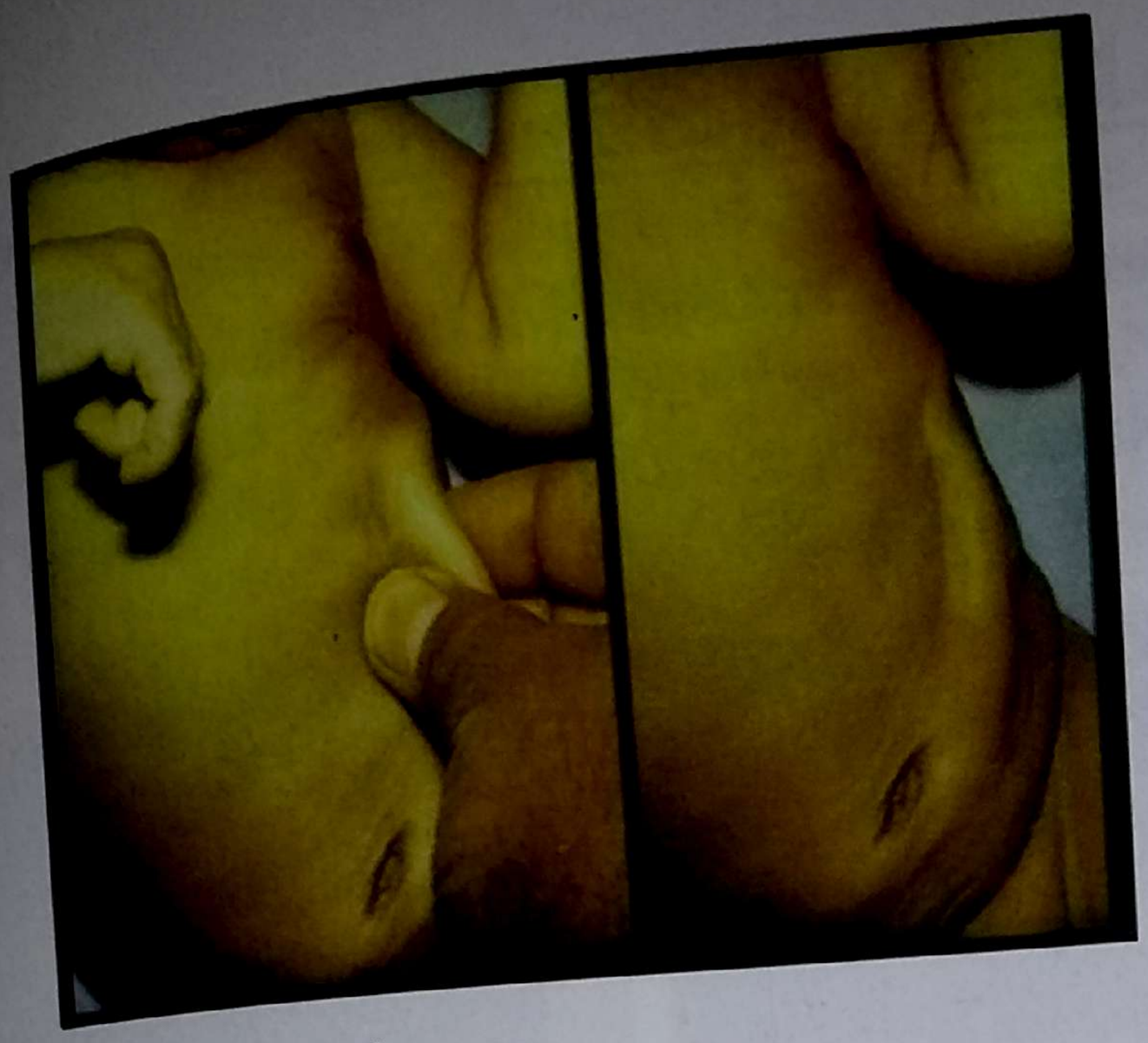
*Purpura fulminans in meningococceemia*

3) Skin roughness : as in vitamin A or Niacin deficiency.
Congenital hypothyroidism.

4) Skin turgor (elasticity ) : by grasping a skin fold in the anterior abdominal wall (midway between umbilicus and lateral border of the abdomen ) and quickly release it. Note the ease by which the skin returns to place.

Decreased skin elasticity occurs in :

- PEM
- Dehydration



5) Skin hardening : scleredema

6) Scratch marks in scabies.

7) Edema of subcutaneous tissue. ( see extremeties)

8) Nails :

-Nail beds : cyanosis , pallor , capillary pulsations

-Hemorrhage under the nails : trauma or in splinter hemorrhages.

-Spoon shaped nails ( Koilonychia) : iron deficiency , congenital.

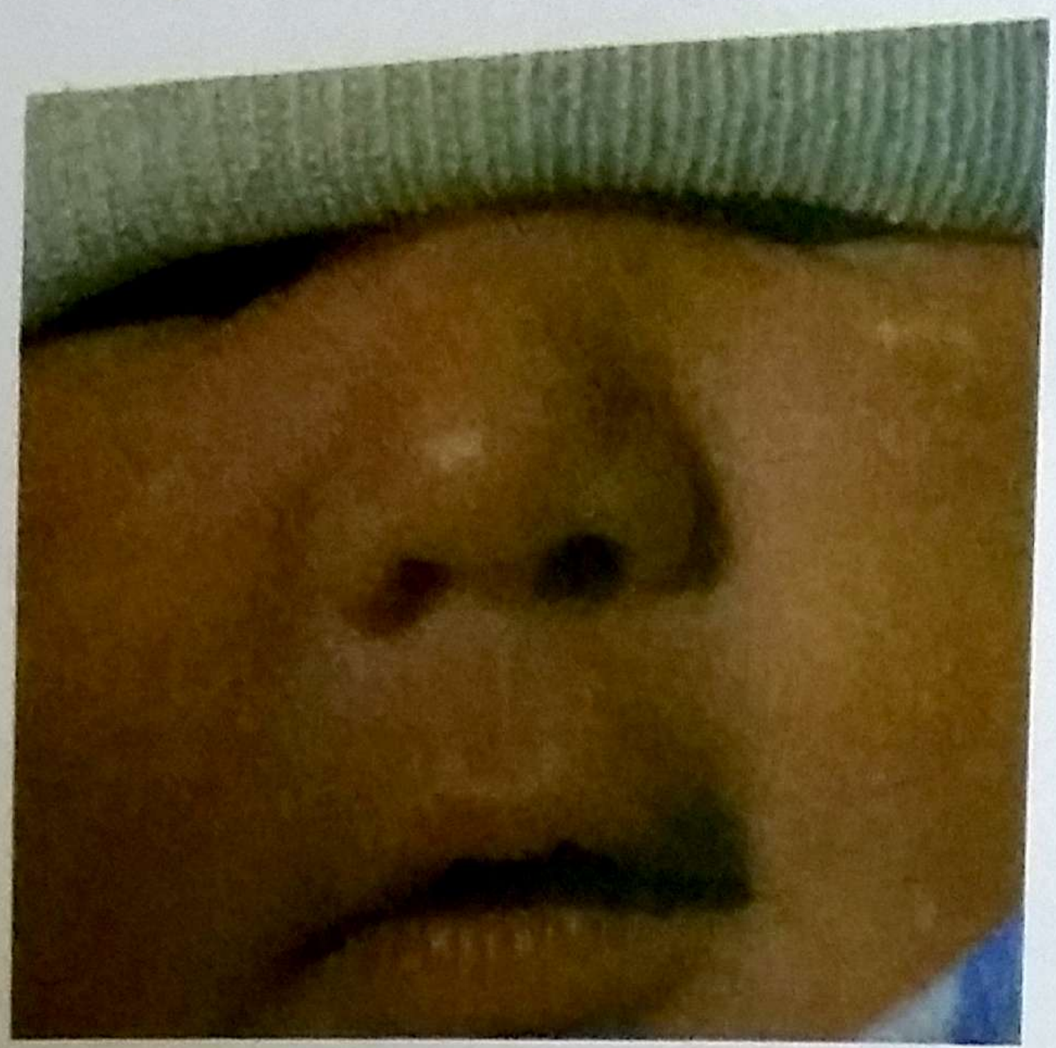
-Clubbing . See examination of extremities .

Koilonychia ( spooning of the nails)

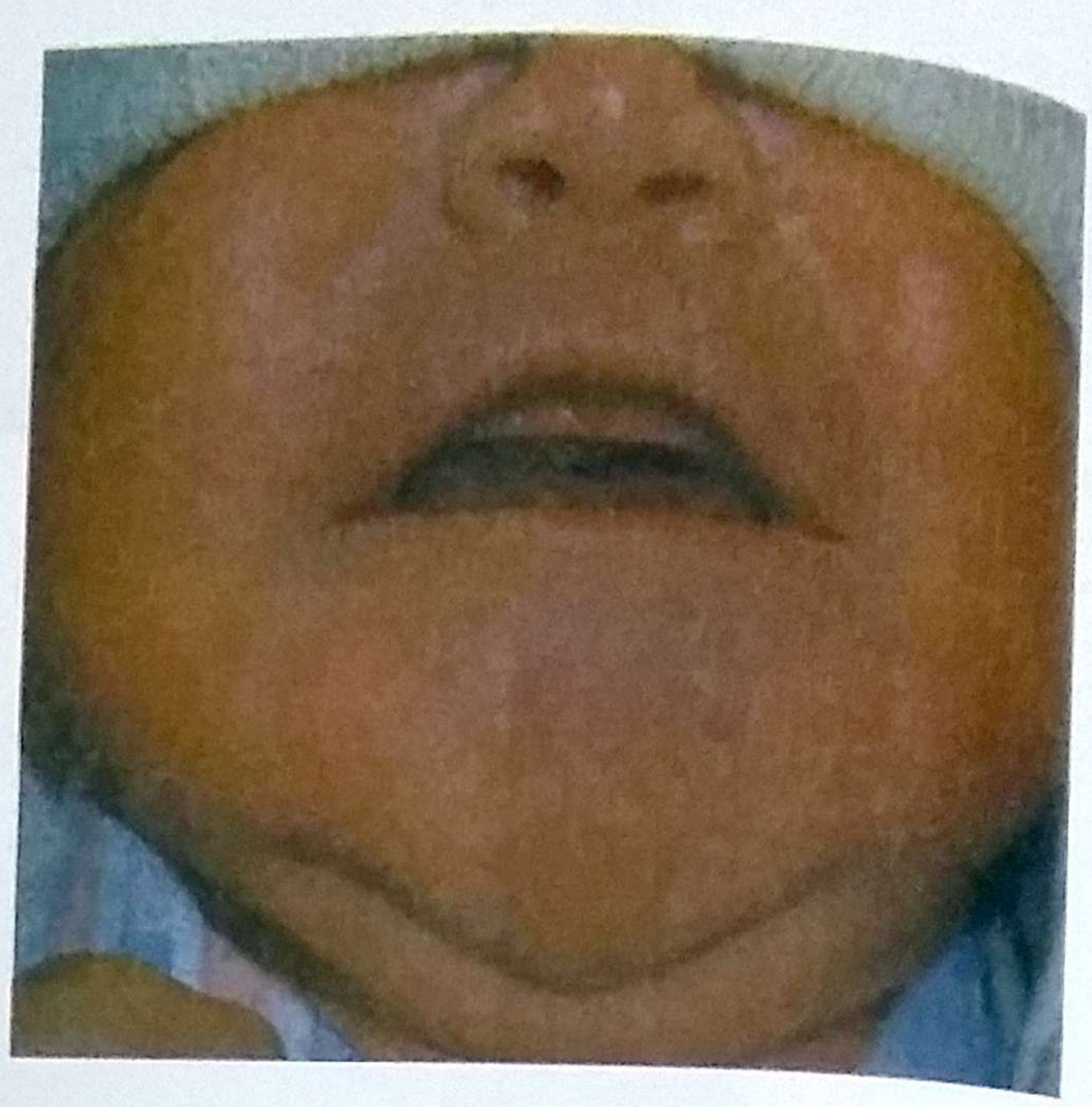
9) Subcutaneous tissue : is examined for loss of fat in PEM ( in marasmus ,it is lost from abdominal wall→ limbs → buccal fat giving old man face). The S.C. fat can be assessed roughly by thickness of skin fold in the abdominal wall ( see skin turgor). More accurate assessment needs measuring the triceps or subscapular skin fold thickness by special calipers. S.C. tissue is also examined for edema ( see examination of extremities ) and +S.C. nodules ( in collagen diseases).

# Transient Neonatal Skin Rash:

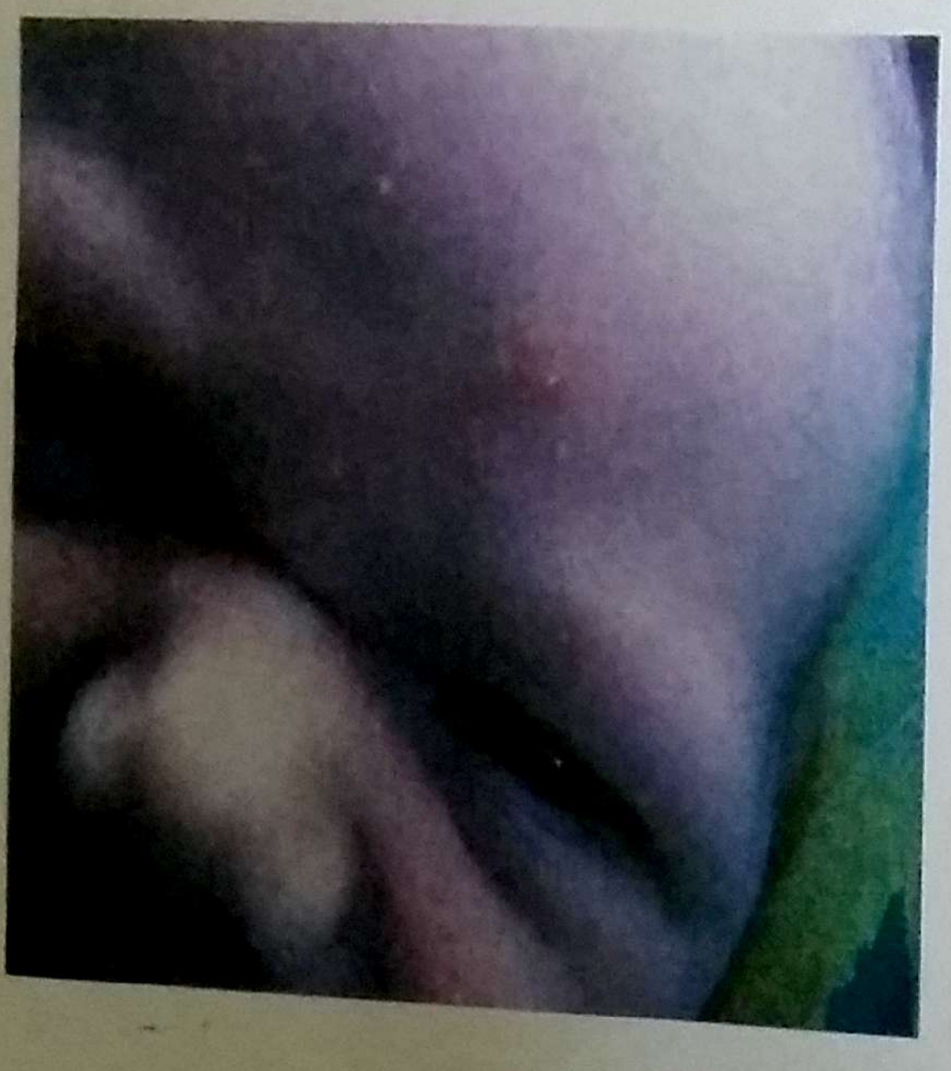
1) **Sebaceous Hyperplasia** : Minute ,yellow –white papules found on the forehead , nose , upper lip , and cheeks of term neonates . They represent hyperplasia of sebaceous glands. The disappear in the first few weeks of life.



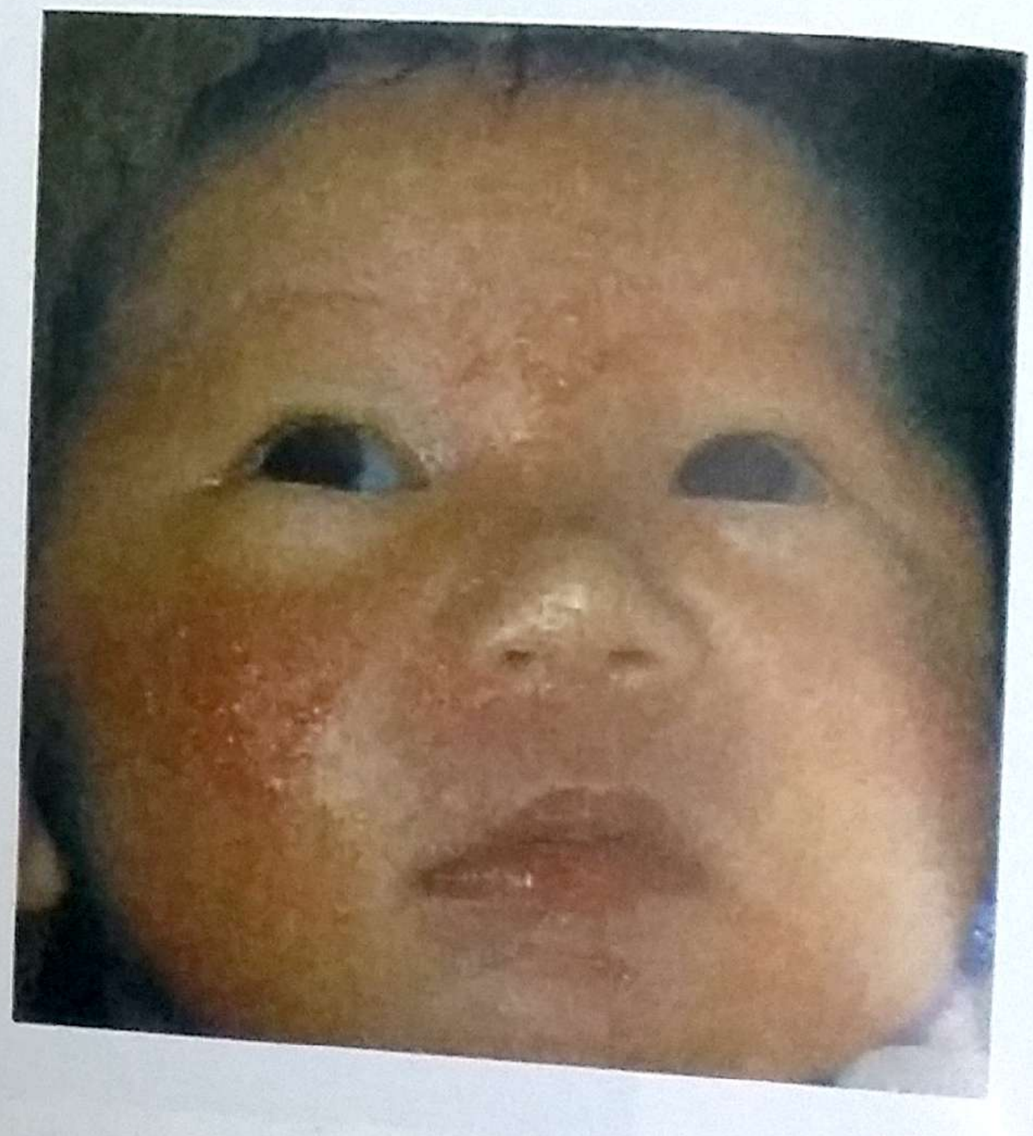
*Sebaceous Hyperplasia*



*Milia*



Milia



Neonatal acne

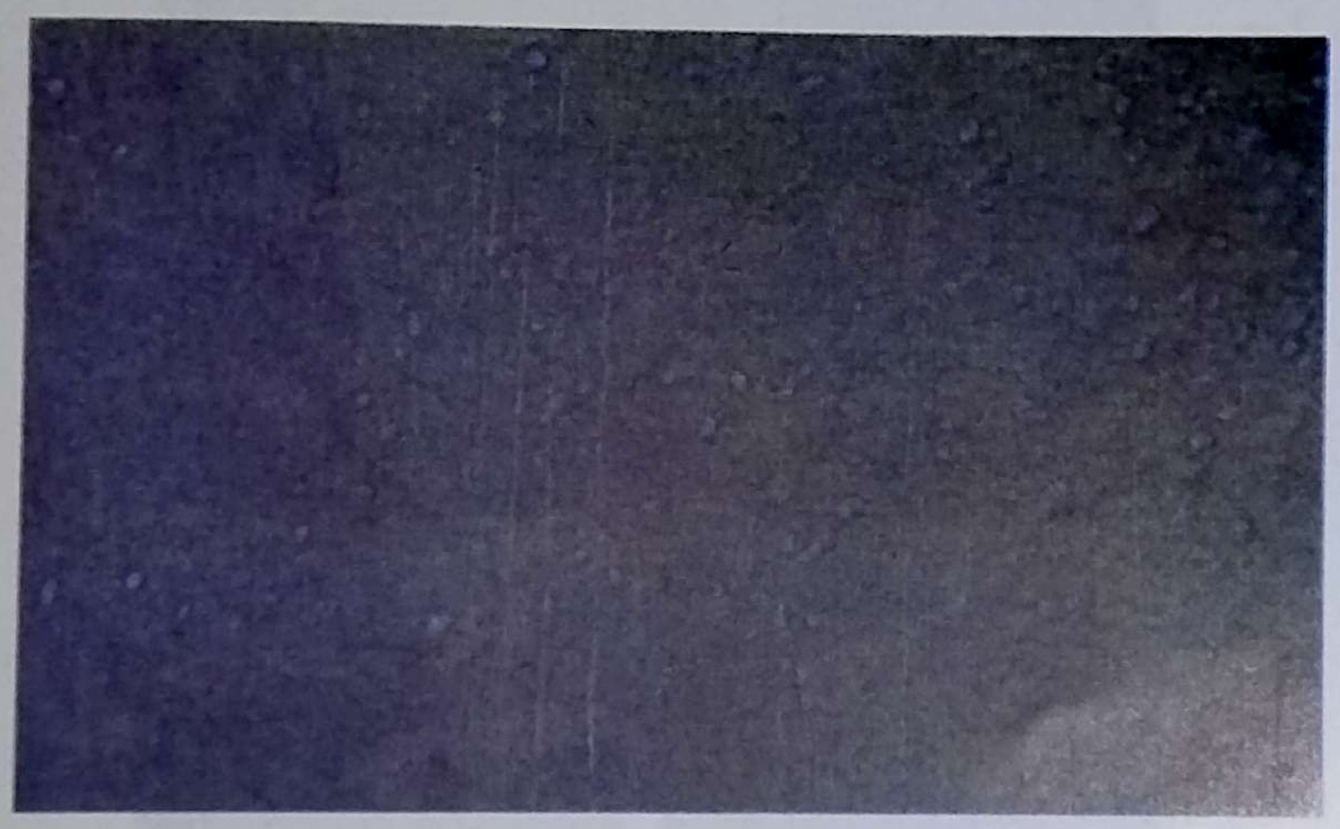
2) **Milia** : Small firm white papules found mainly on chin, cheeks and may be the forehead ( epithelial retention cysts).

3) **Neonatal acne** : (acne neonatorum) is a common condition that affects about 20 percent of newborn babies. The condition is due to stimulation of the baby's sebaceous glands by maternal hormones that cross the placenta.

**2) Erythema Toxicum:** benign self limited eruption occurs in about 50% of full term infants , prematures are affected less commonly. The lesions are papules or pustules 1-2mm with surrounding erythema. Sometimes, patches of erythema are the only manifestations. Onset in 2nd day of life. No treatment is needed .

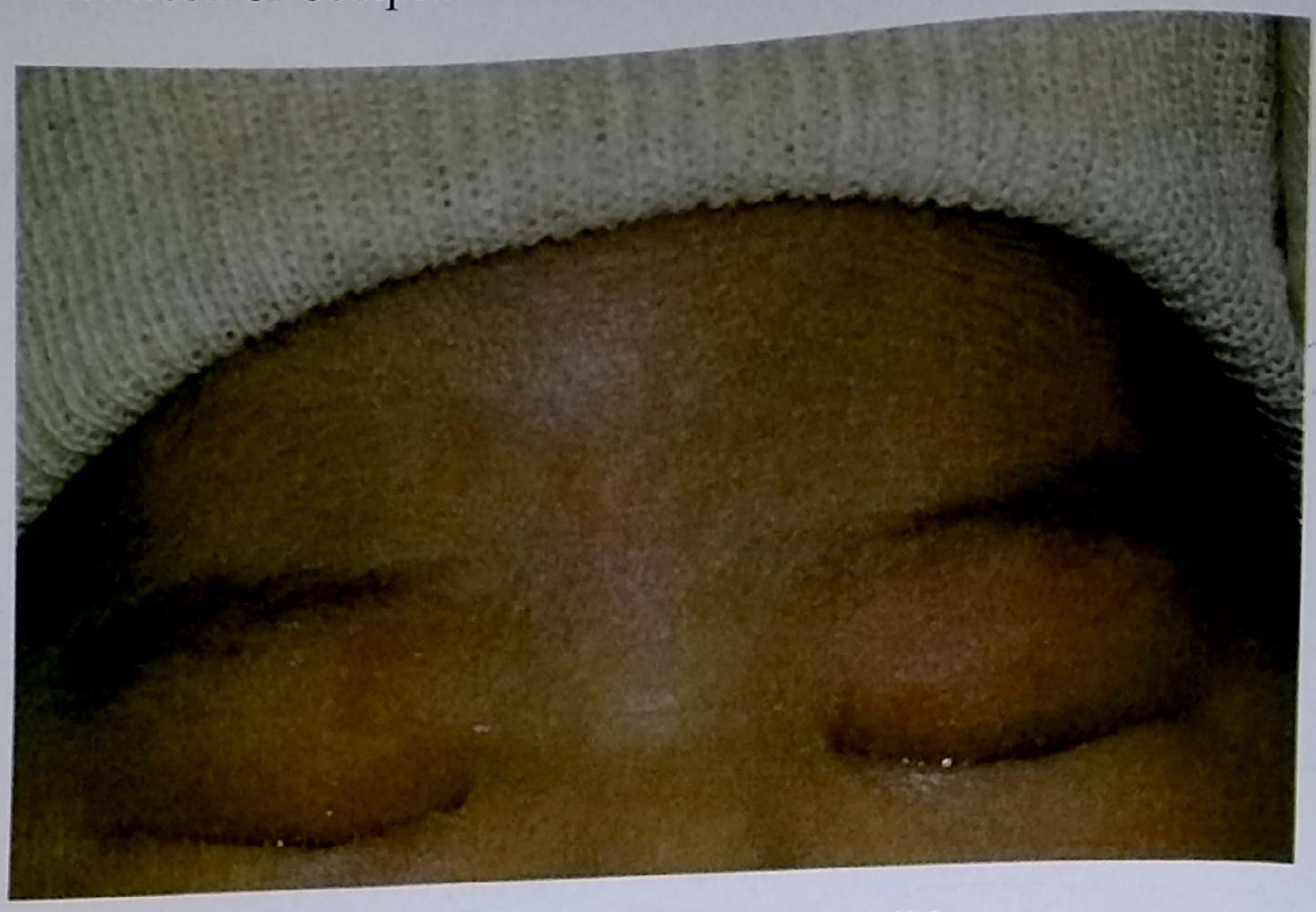
*Erythema Toxicum*

**3) Miliaria ( vesicular sweat rash)** : collections of tiny vesicles on the head and chest of babies who have been sweating because of illness or overheating.



*Miliaria*

4) Salmon patch ( nevus simplex) : Salmon patches are small , pale pink, ill-defined, vascular macules that occur most commonly on the glabella, eyelids, upper lip, and nuchal area of 30-40% of normal newborn infants. Most lesions of the face fade and disappear completely . Those on the posterior neck or occipital area usually persist.



Salmon patch on glabella and eyelids

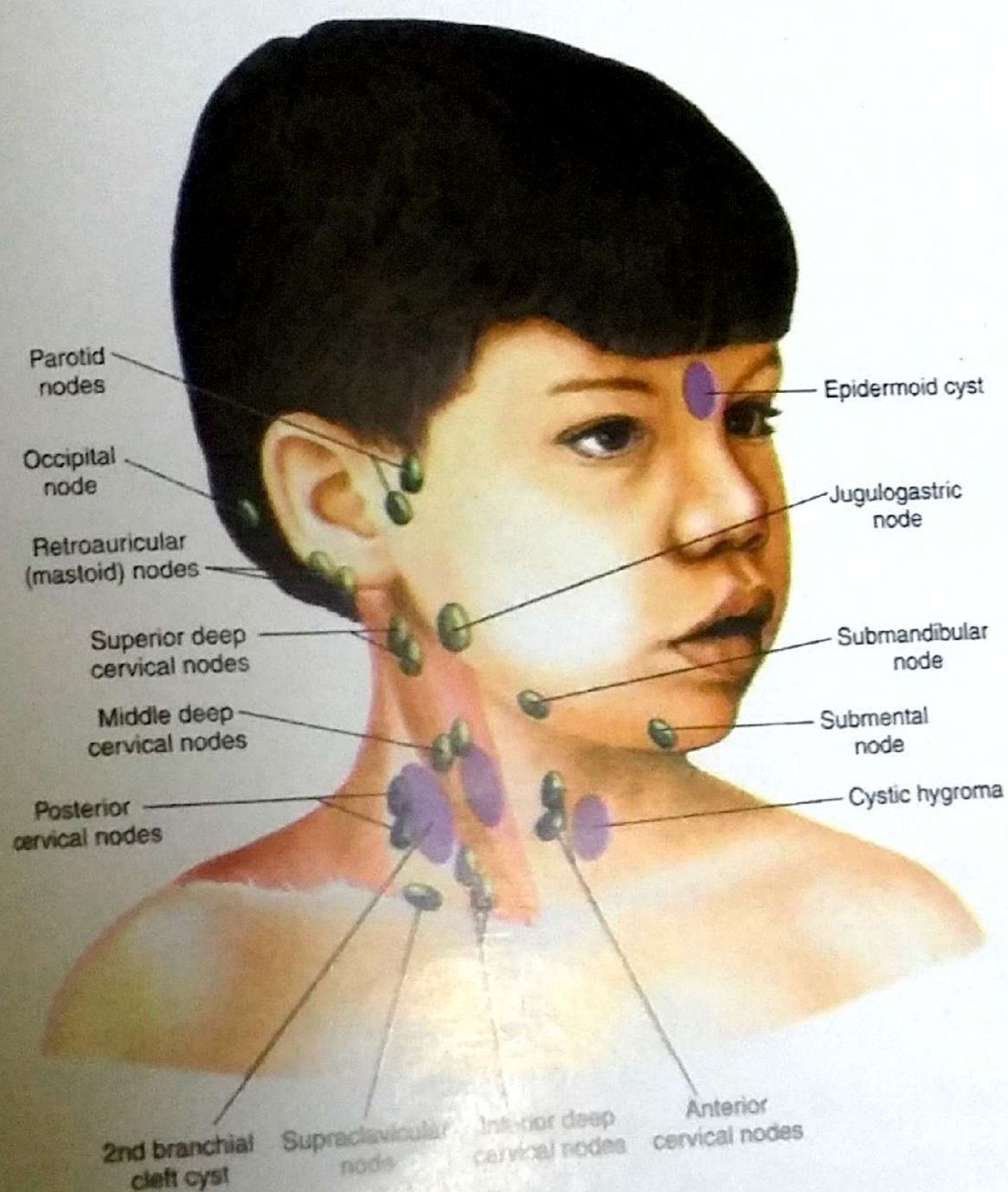
Salmon patches on the nuchal region

5) Mongolian Spots : mentioned in ( skin pigmentation).

6) Transient pustular melanosis ( or dermatosis) : Transient , benign self limited dermatosis characterized by superficial pustules, ruptured pustules with a collarette of fine scale and hyperpigmented macules. Pustules represent the early phase of the disorder. No therapy is required.

Pustular melanosis (or dermatosis) in the feet of a newborn

# Lymph Nodes



# Lymph nodes :

They are generally examined during the examination of the part of the body in which they are located.
Using the distal portions of the fingers and gentle but firm circular motions , palpate the head , neck ,axillae and groin to detect enlarged lymph nodes.

Comment on :
size ,
consistency ,
tenderness ,
mobility ,
attachment to overlying skin or underlying structures.

Causes of generalized lymphadenopathy : include

1- Infections :
Bacterial : streptococcal infections, bacteremia, syphilis, plague , tuberculosis.
Viral : infectious mononucleosis , cytomegalovirus or AIDS.
Parasitic : toxoplasma
2- Leukemia and lymphoma.
3- Serum sickness
4- Collagen diseases : as SLE.
5- Miscellaneous : as histiocytosis.

*Clinical Notes :*

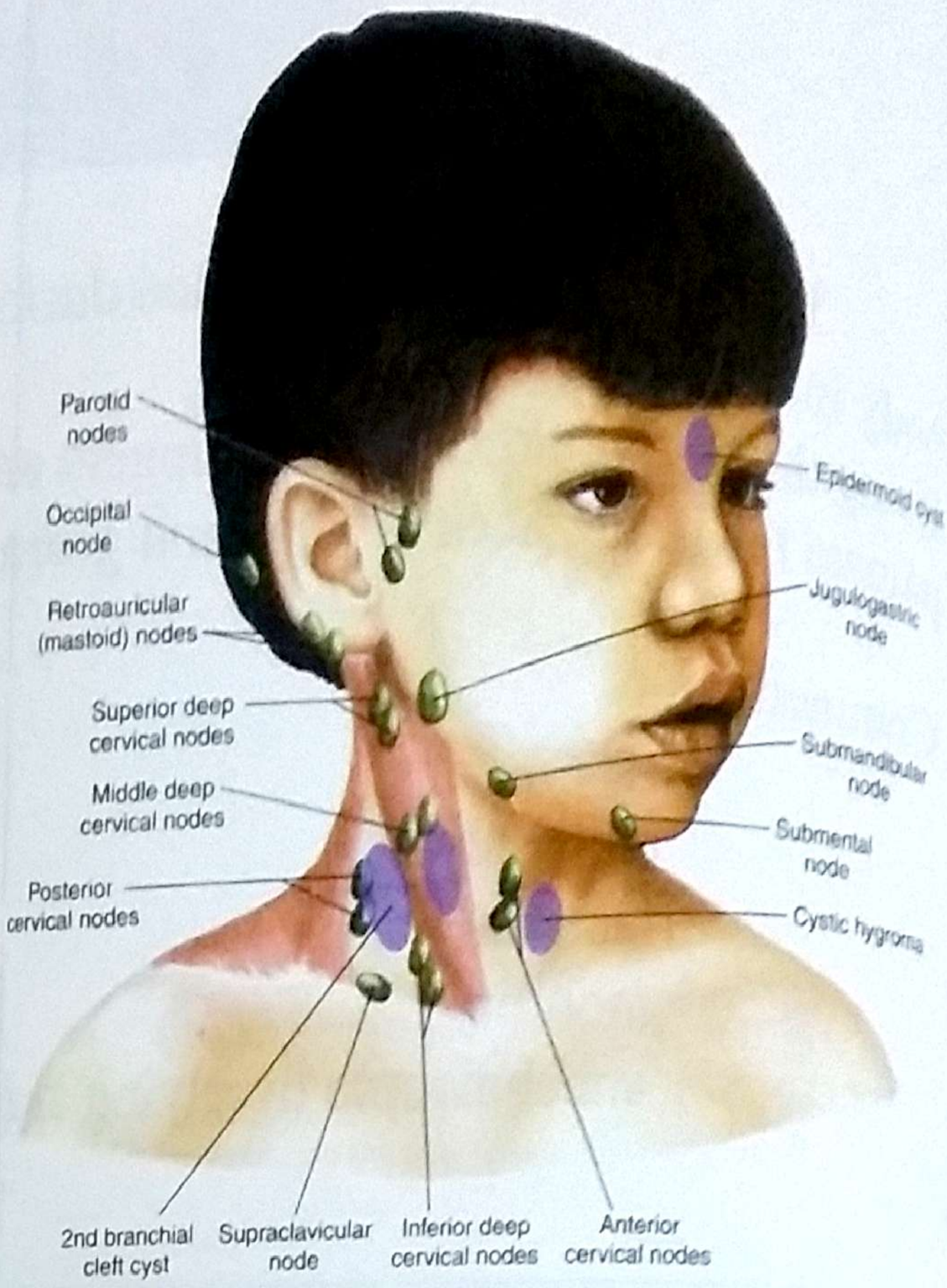
1- Small ( < 1 cm in diameter) , mobile, non tender nodes are palpable to a variable degree in normal infants and children in cervical , axillary, and inguinal regions.
2- Large , firm , tender , mobile lymph nodes : acute infections.
3- Firm , rubbery, non tender nodes are common in leukemia.
4- Firm nodes that adhere to each other and to the skin are formed in children with T.B.
5- Rapidly growing lymph nodes that are fixed to underlying tissues or are hard in consistency occur in malignancy.

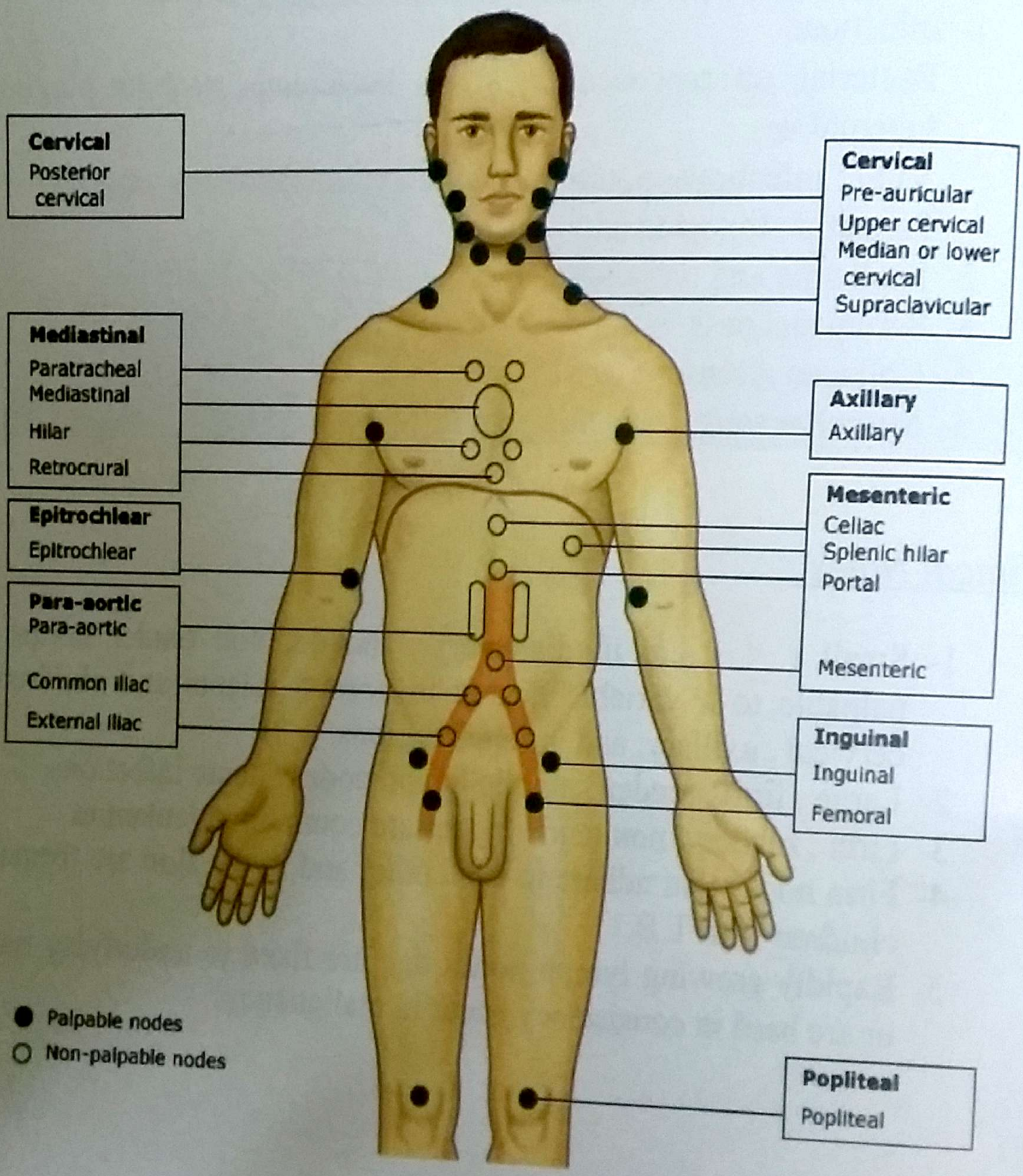
6- Mediastinal lymph nodes are examined by D'Espine sign ( see chest examination ).

7- Mediastinal lymphadenopathy may cause stridor , cyanosis, dyspnea, dysphagia, cough , edema of the face and venous congestion.

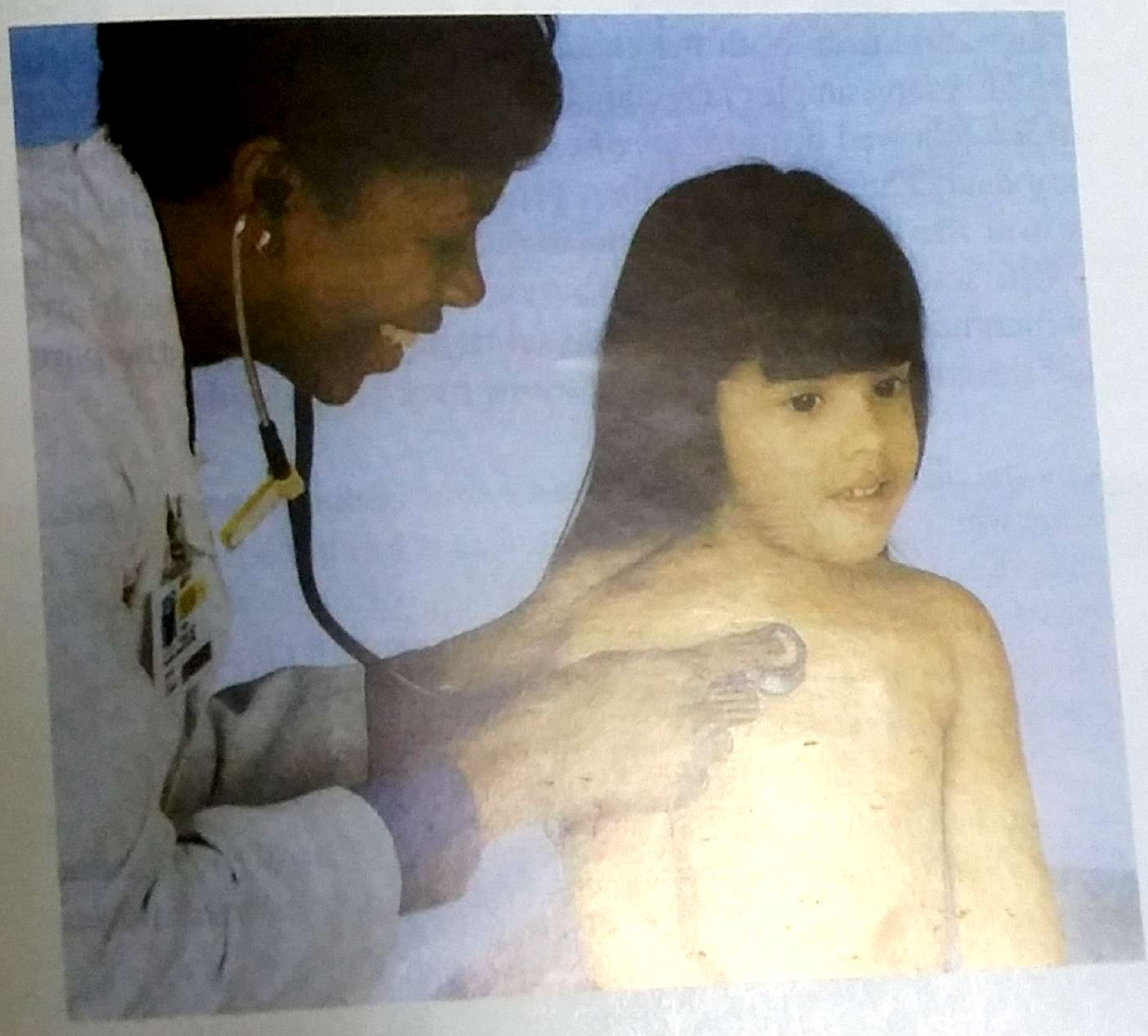
8- Mesenteric and retroperitoneal adenopathy may cause abdominal pain .

9- Iliac adenitis may cause abdominal pain , tenderness in iliac regions. and a limp



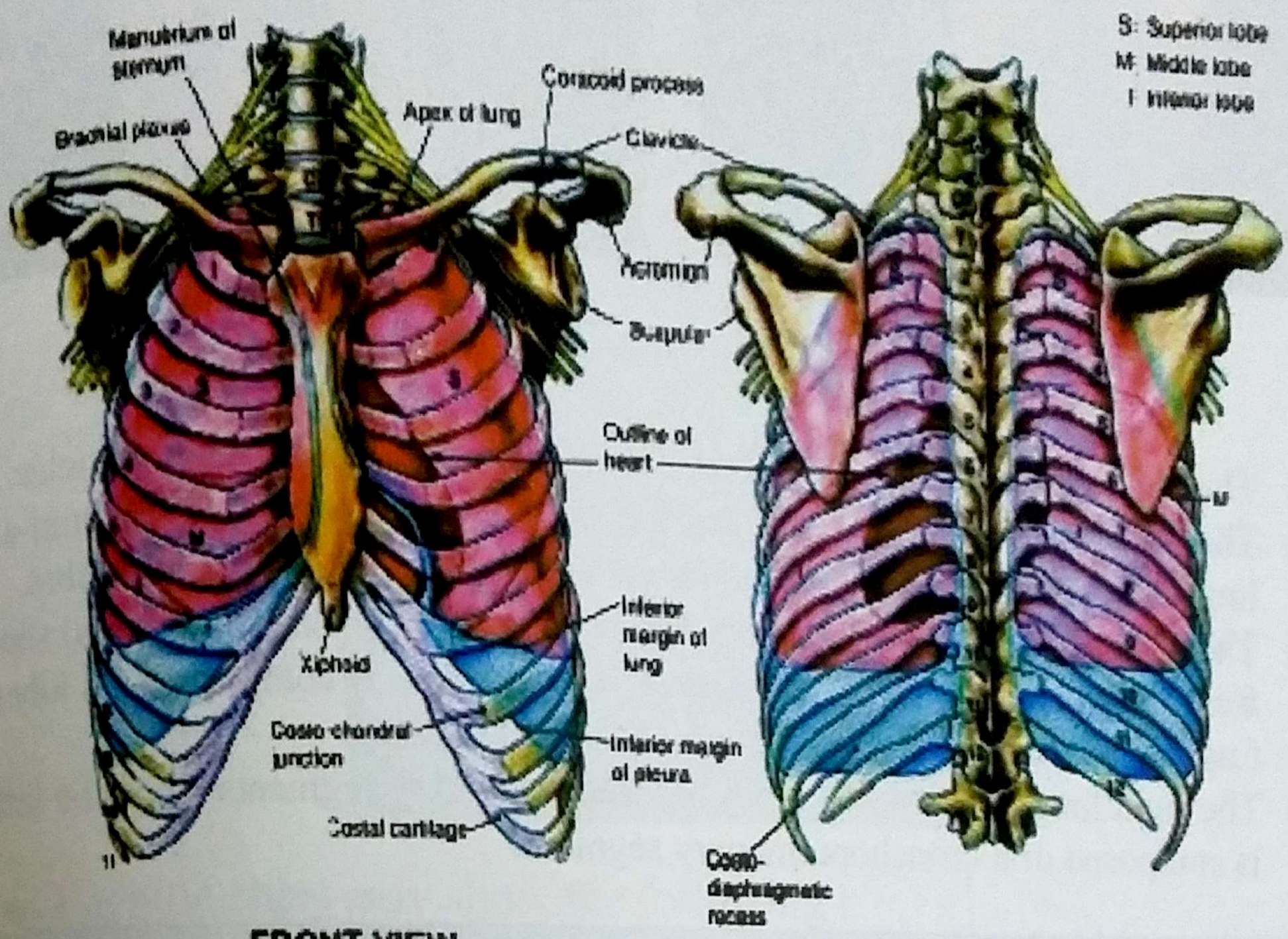



# Chest Examination



# Chest Examination :

## THORACIC ANATOMY




FRONT VIEW

BACK VIEW

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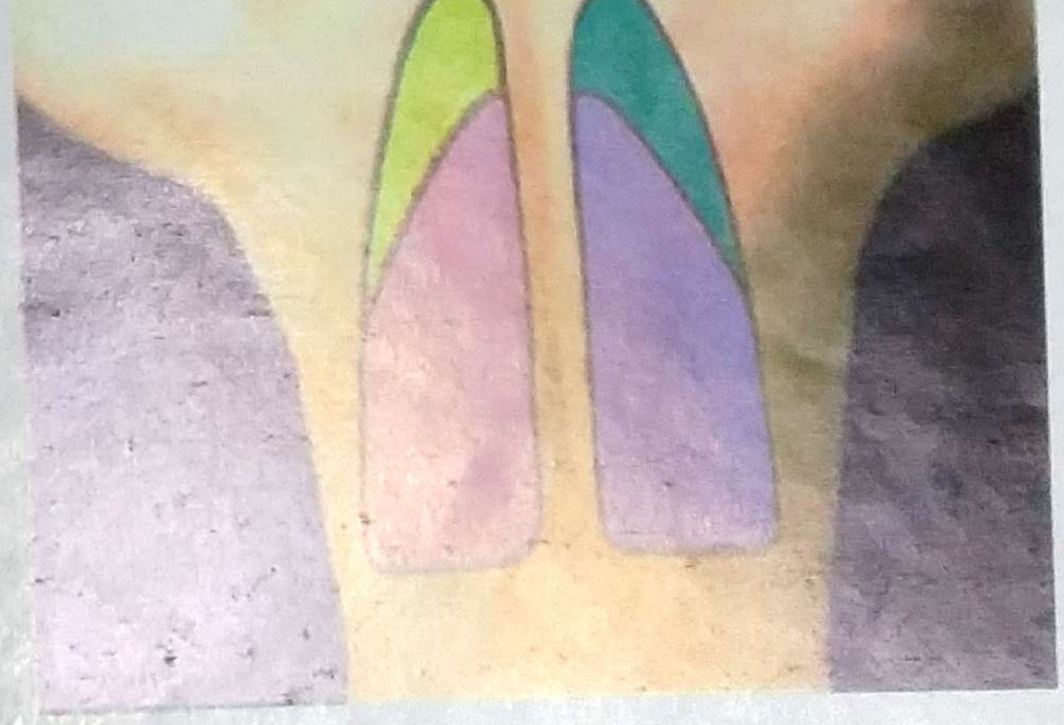
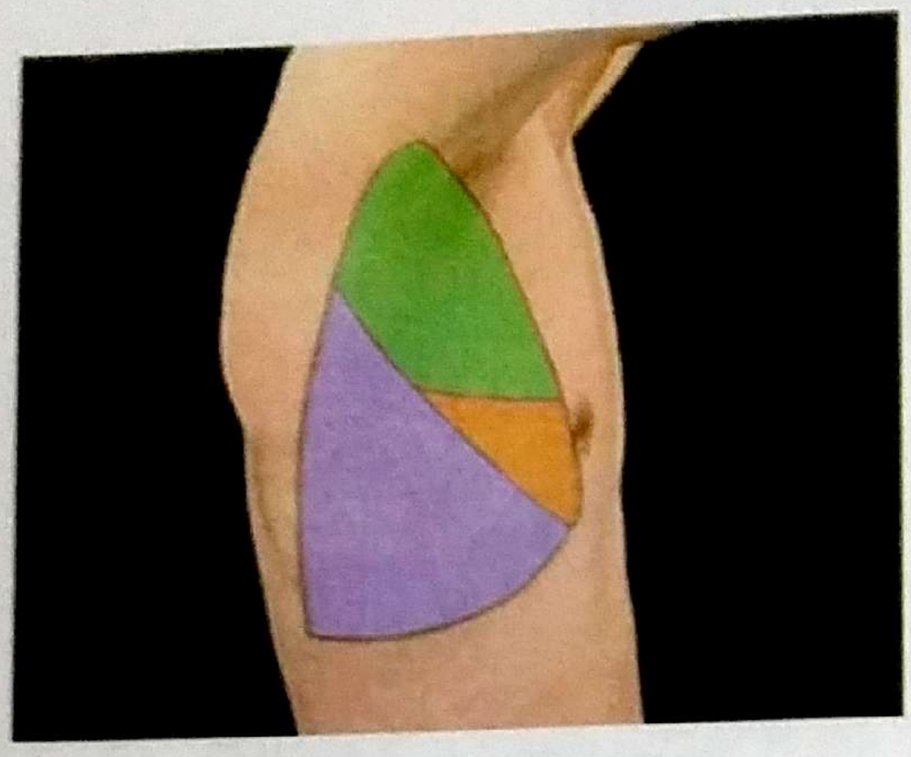
## Surface anatomy of the lungs

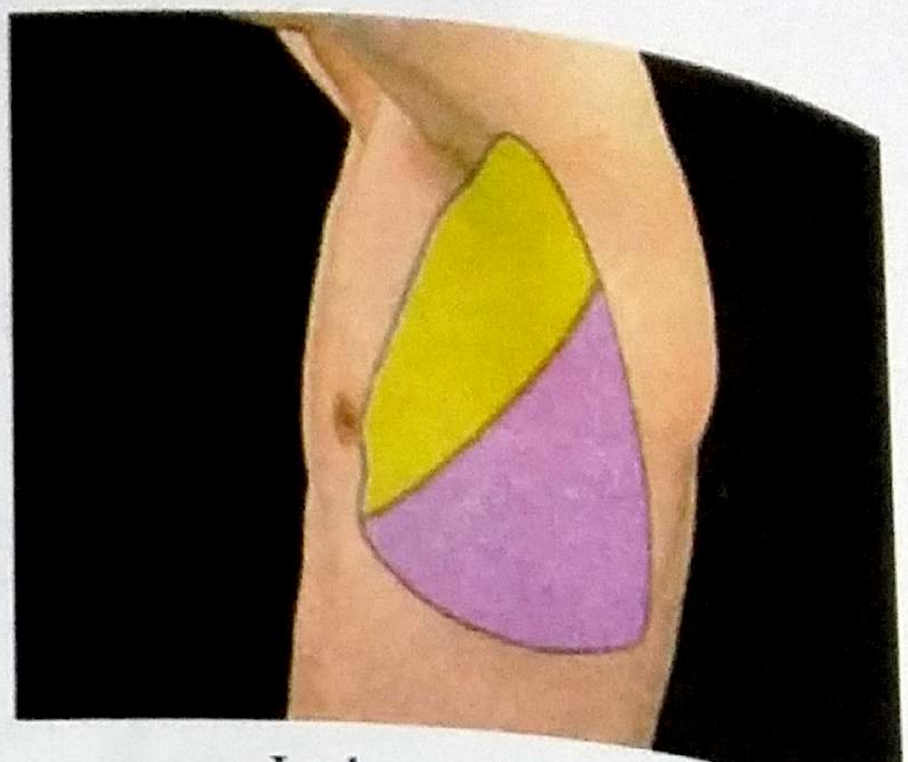
Front of the chest



Back of the chest



Rt lateral view



Lt lateral view

1) The apices of the lungs rise 2-3 cm above the medial thirds of the clavicles.
2) The lower border of the lung meet the mid-clavicular line at 6th rib, mid-axillary line at the 8th rib and the scapular line at the level of 10th thoracic vertebra.
3) The right lung is composed of 3 lobes ( upper , middle and lower lobes) separated from each other by interlobar fissures. The left lung is composed of 2 lobes only ( upper and lower) separated by an interlobar fissure.
4) The right lung is composed of 10 bronchopulmonary segments while the left lung is composed of 8 bronchopulmonary segments .

| Bronchopulmonary segments of the lungs | |
|---|---|
| Right Lung | Left lung |
| Upper lobe : 3 segments ( anterior , apical and posterior.<br><br>Middle lobe : 2 segments (medial and lateral).<br><br>Lower lobe : 5 segments ( apical , anterior , posterior, medial and lateral) | Upper lobe : 2 segments ( anterior and apicoposterior ).<br><br>Lingula : 2 segments ( superior and inferior).<br><br>Lower lobe : 4 segments ( apical , anterior , posterior and lateral ) |

5) The lung fissures :
   a- Oblique fissure ( in both lungs) : a line drawn from the 3rd thoracic spine posteriorly slanting downwards and laterally to cut 5th rib in the mid- axillary line and ends at the 6th costal cartilage anteriorly .

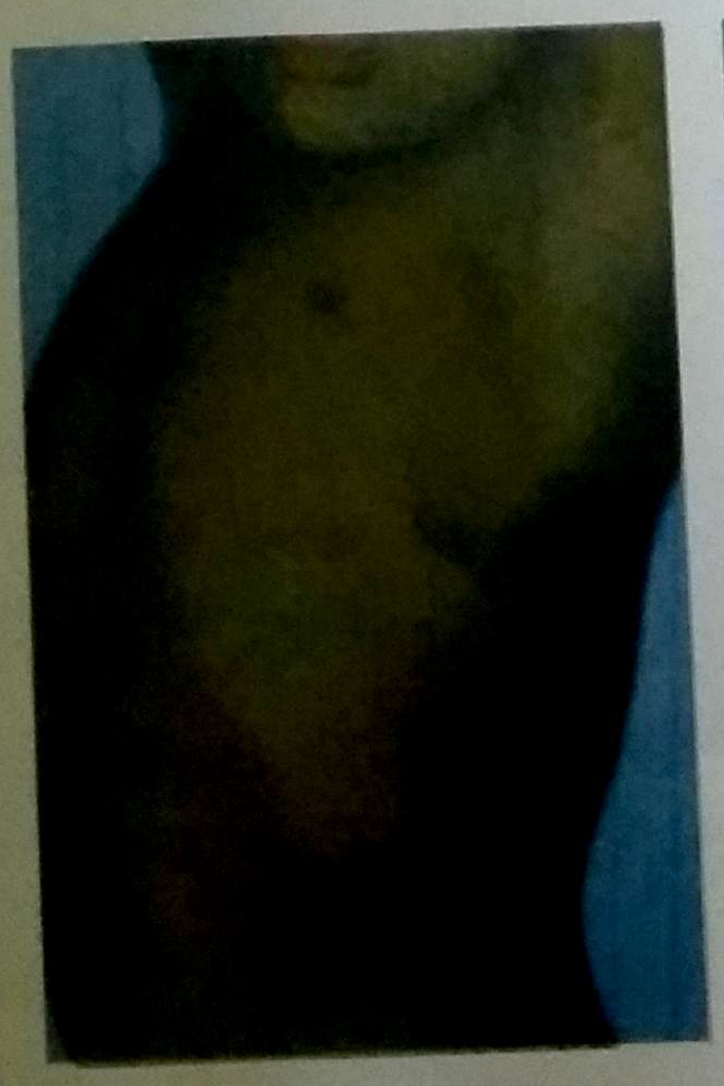
   b- Transverse fissure ( right lung only): a line drawn from the costal cartilage of the 4th rib anteriorly to meet the oblique fissure at the 5th rib in the mid-axillary line.

d- Pigeon breast deformity ( pectus carinatum) :

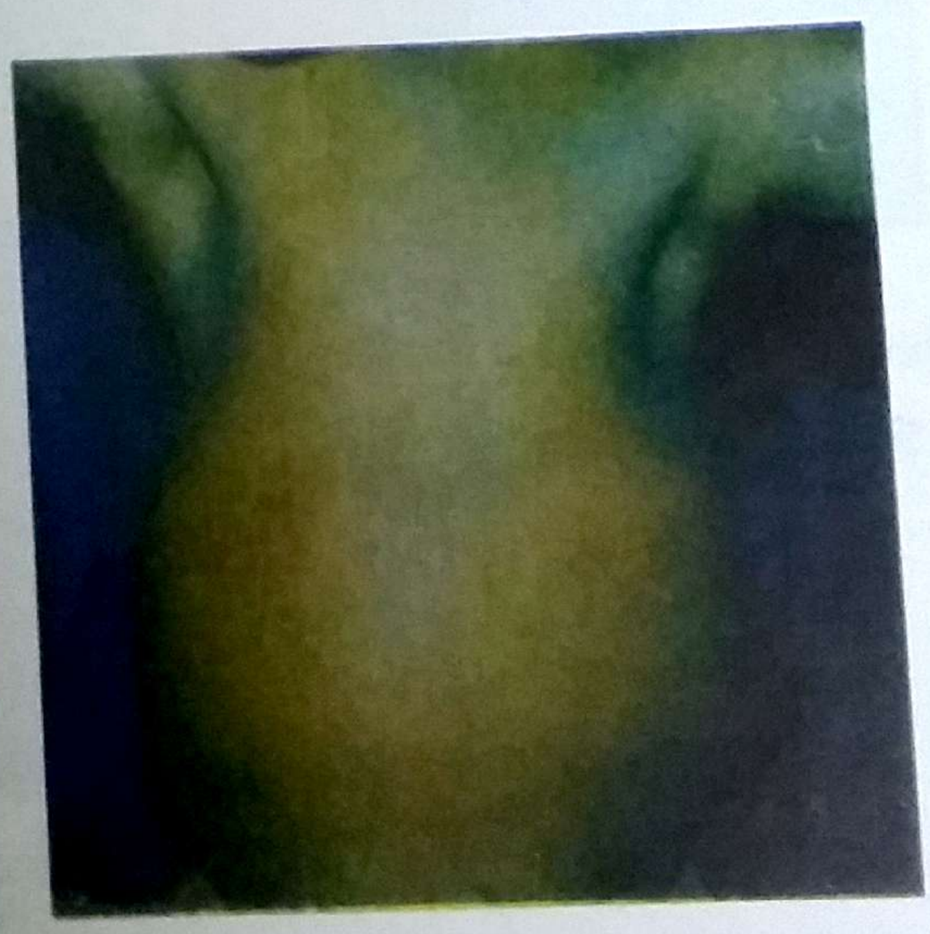
- The anteroposterior diameter is larger than the transverse .
- The sternum is protruded forwards .
- The subcostal angle is acute .
- The cross section of the chest is nearly triangular.
- It is seen in severe rickets.

e- Rachitic chest may show the following :

- Rachitic rosaries : enlargement of the medial ends of the ribs at costochondral junctions.
-Harrison groove : a horizontal depression of the chest cage along the attachment of the diaphragm extending from the lower end of the sternum to the mid-axillary line .
- Lateral groove longitudinal develops lateral to rosaries
- Everted costal margin..



*Rachitic rosary*



*Harrison sulcus*

## I) Inspection :

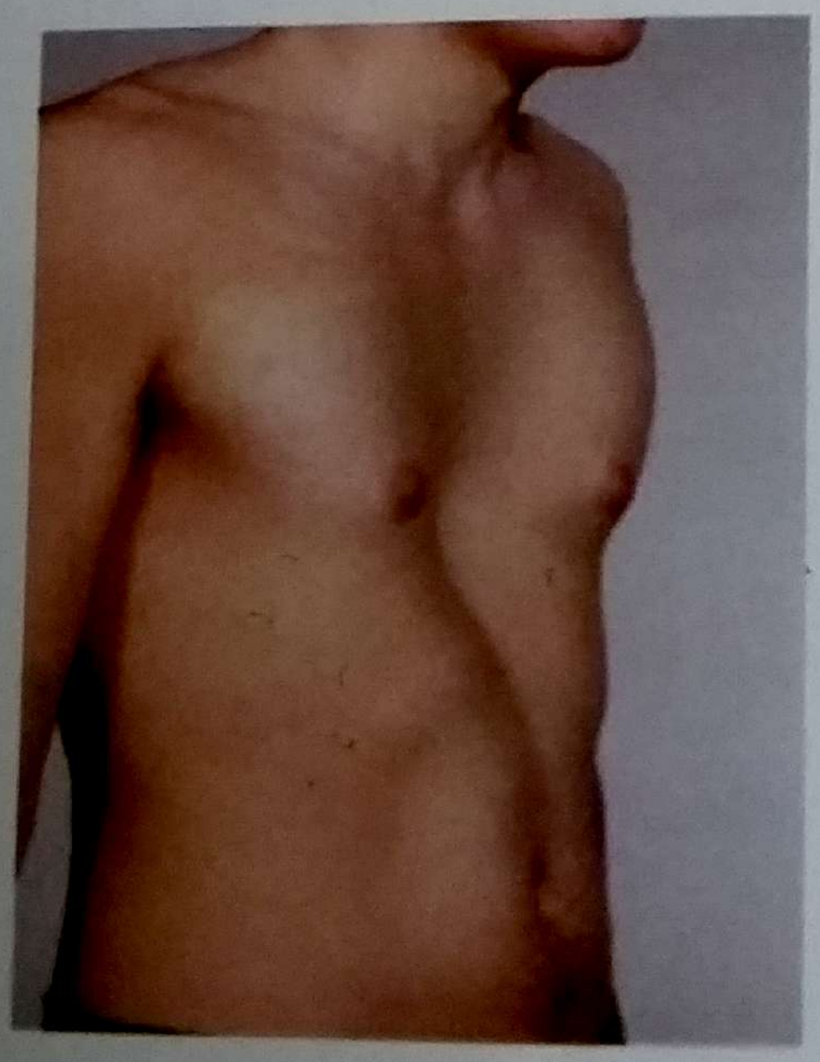
1- Shape of the chest :

The newborn's thorax is nearly rounded . Gradually the transverse diameter increases until the chest assumes the elliptical shape of the adult at about 6 years of age.

Abnormalities in shape :

a- Unilateral bulge : severe pleural effusion or tension pneumothorax.
b- Unilateral depression : collapse or fibrosis of the lung.
c- Barrel shaped chest :
-increased anteroposterior diameter to become equal to the transverse diameter .
-ribs become more transverse and the intercostal spaces wider ,
-posterior kyphosis of the thoracic vertebrae.
-Obtuse subcostal angle.
-may occur in severe persistent bronchial asthma.

d- Funnel chest ( pectus excavatum ) : The lower part of the sternum is indented inwards. It may compromise lung expansion. It is mostly congenital anomaly.



*Pectus Excavatum*

## 2- Respiratory Movements :

a- Rate , rhythm , depth : see vital signs.

b- limited movements :

- if unilateral : lobar pneumonia , effusion, collapse , fibrosis or pneumothorax.
- If bilateral : severe asthma.

## 3- Intercostal retractions ( during inspiration ) :

-Observe for retractions in the supraclavicular , suprasternal and intercostal spaces.

- Observe for chest indrawing ( lower chest wall indrawing). It does not include intercostal indrawing .

*Causes of intercostal retractions :*

Airway obstruction ( upper or lower ).

Lung diseases as consolidation, collapse ,or fibrosis

Large left to right shunt as large VSD.

Paralysis of intercostals muscles .

*- Retractions are caused by increased negativity of intrapleural pressure especially in conditions that limit distensibility of the lungs.*

## 4- Dilated veins in chest wall : in SVC obstruction.

5- Local swellings , pigmentation , scars, subcutaneous emphysema , in the chest wall.

## II -Palpation :

1- Position of the mediastinum :

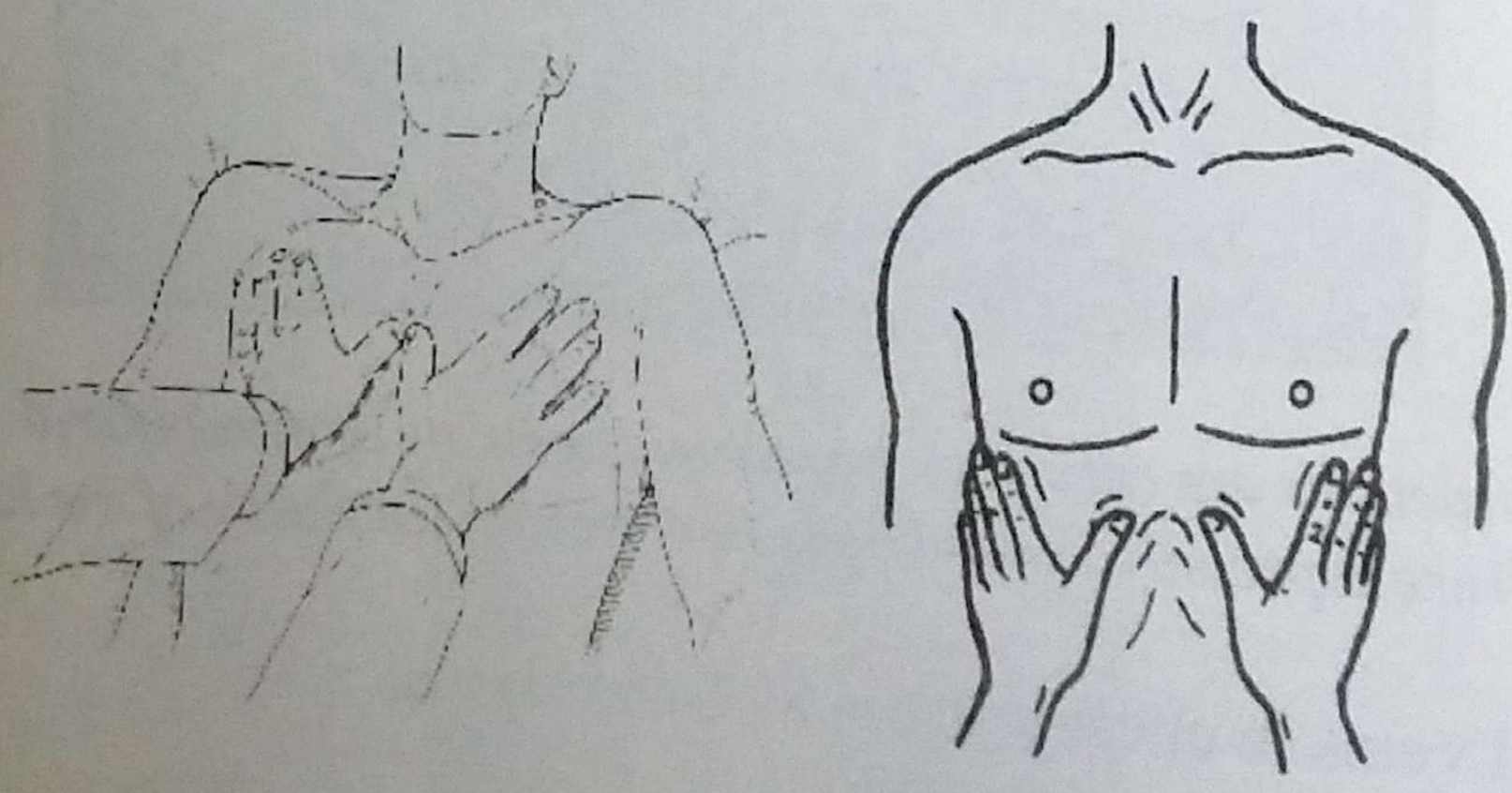
-Position of the trachea indicates the position of upper mediastinum .
-Position of the apex of the heart indicates position of the lower mediastinum.
-To examine position of the trachea, the neck is centralized and the distance between the trachea and medial border of sternomastoid muscle is assessed on both sides using the index finger.
-The apex is determined as in heart examination.

**Causes of shifted mediastinum:**

a- Collapse of the lung which pulls the mediastinum to the same site of the lesion .
b- Pleural effusion , or pneumothorax which push mediastinum to opposite side.

2- Respiratory movement and expansion of the chest :

To assess respiratory movements, the hands are placed on the chest ( anteriorly and posteriorly ) with the thumbs in the midline . The movement of both thumbs away from the midline is observed.



*Examination of movements of the chest anteriorly*

3- Tactile vocal fremitus ( TVF) :

- Palpate for TVF using the palmer surface of a single hand.
- Palpate the lung lobes on both sides while the child says 44 in arabic. In infants, TVF can be assessed during crying.
- Increased TVF : in consolidation.
- Decreased TVF : pleural effusion , lung collapse , pneumothorax,.

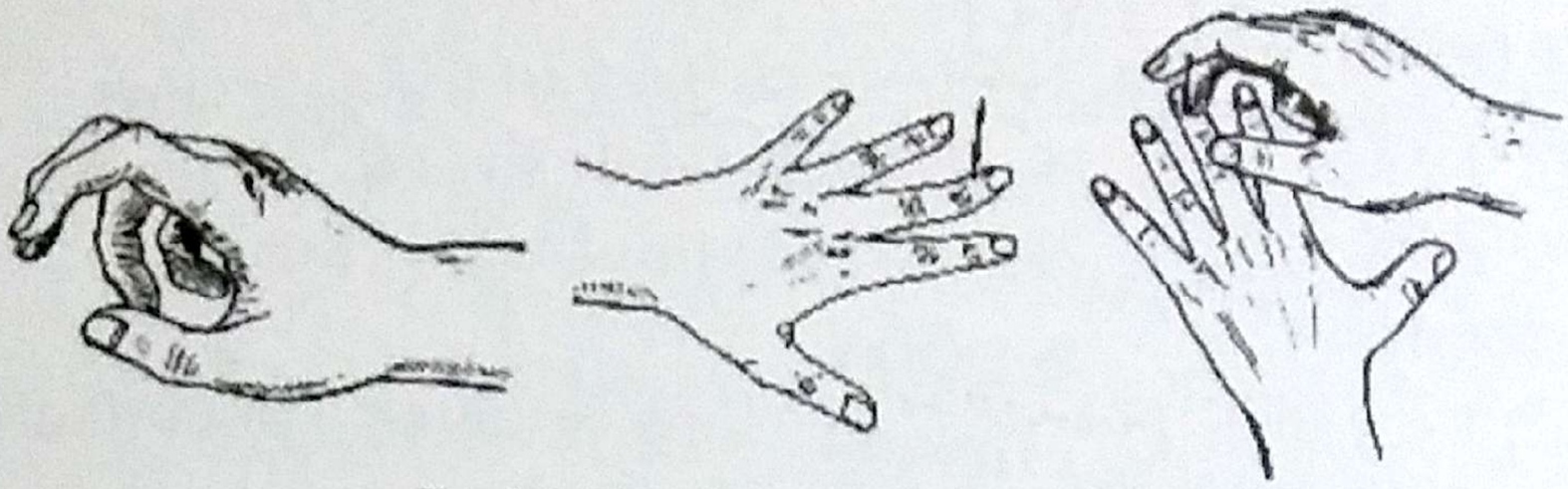
4- Palpable rhonchi ( rhonchus fremitus ) : in bronchial asthma , or wheezy chest due to F.B. or bronchiolitis , the wheezes may be palpable by the examiner's hands,

5- Palpate any swelling in the chest wall , and detect any sites of tenderness .

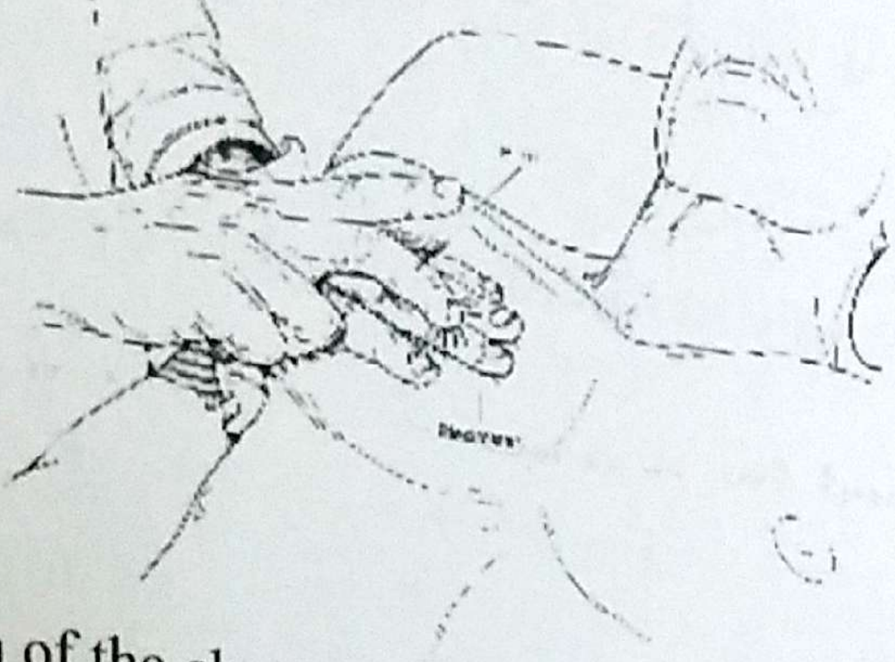
## III: Percussion :

General Considerations :

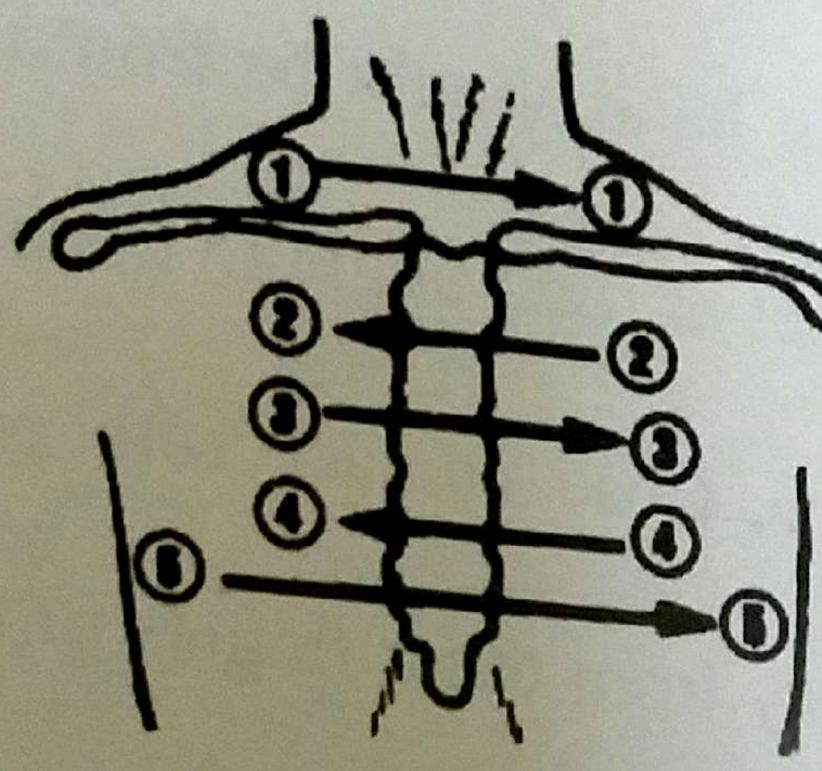
- Movement of the right percussing hand should be from the wrist joint .
- The percussing finger must be kept at right angle to the percussed finger as it falls.
- The percussed finger must be in close contact with percussed surface.
- The percussed finger must be away from other fingers of the hand ( fanning of fingers ).
- The percussed finger must be parallel to the border to be percussed.
- Percussion should be from resonance to dullness.
- Percuss the intercostal spaces on both sides .
- The child usually lies on back when the chest is percussed anteriorly and sits when percussed posteriorly.
- In infants percuss directly on the chest wall ( not on the middle finger).



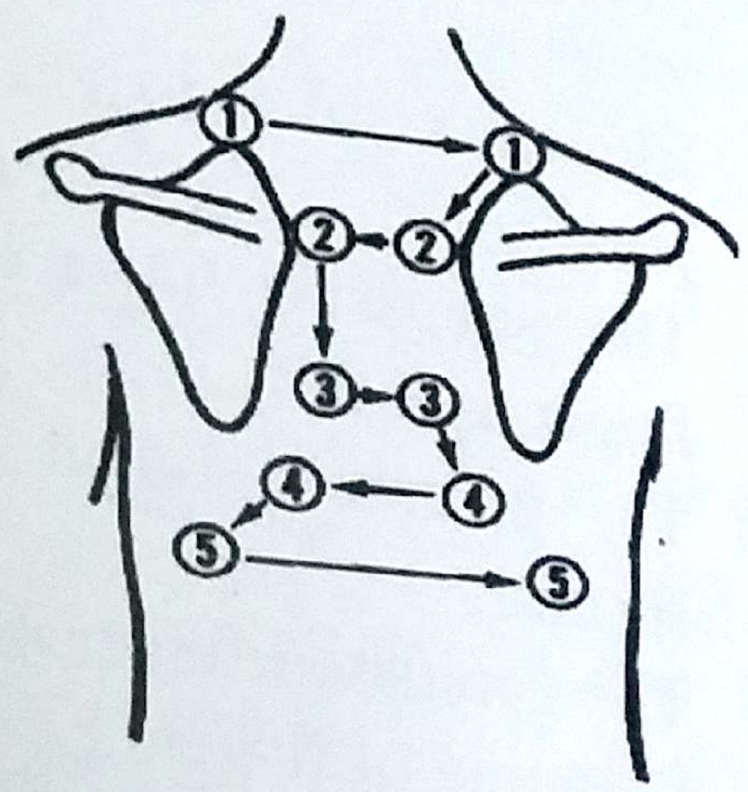
Position of the hands during percussion



Percussion of the chest anteriorly ( in mid-clavicular line)



Areas of percussion and auscultation anteriorly



Areas of percussion and auscultation posteriorly

***Types of percussion notes :***

a- Tympanitic : in pneumothorax.
b- Hyper-resonance ; in hyperinflated lung.
c- Resonant : in normal lung.
d- Dull : consolidation , collapse or thick pleura.
e- Stony dull : pleural effusion.

1- Percussion of the chest anteriorly :

- Compare between both sides .
- Percuss the lung along the following lines : Midclavicular , anterior , middle and posterior axillary lines.

2- Percussion of the chest posteriorly : along scapular and paravertebral lines.

3- Tidal percussion ( in cooperative children)

- It is used to differentiate between supra-diaphragmatic and infra-diaphragmatic dullness ( e.g. to differentiate if dullness in $4^{th}$ or $5^{th}$ spaces in right mid-clavicular line is due to pleural effusion or the upper border of the liver ).

- It is performed by percussion of the dull intercostal space during expiration and once again during deep inspiration :

If no change in note → the dullness is supra-diaphragmatic ( lung or pleura)

If change in note occurs ( become resonant in inspiration) → the dullness is infra-diaphragmatic .

4- Percussion of Traube's area : It is an area of tympanitic note overlying the fundus of the stomach . Traube's area is bounded by :

Right border : left border of the liver .
Left border : anterior border of the spleen.
Upper border : lower border of the lung.
Lower border : left costal margin .

*Causes of dullness in Traube's area :*

*1- pleural effusion*
*2- Ascites*
*3- Full stomach or situs inversus*
*4- Abdominal tumors*
*5- Splenomegaly*
*6- Hepatomegaly.*

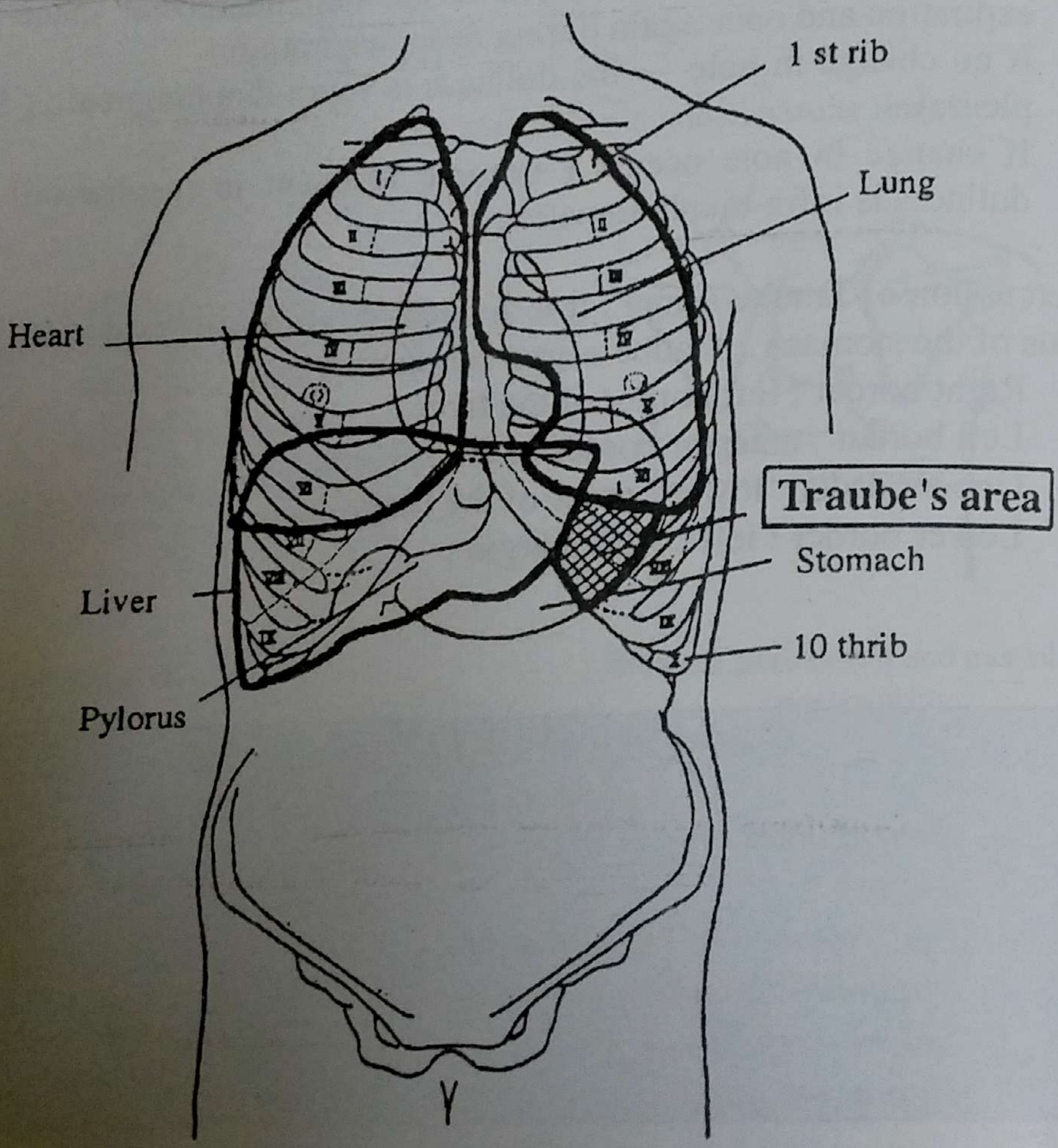
## 5- Percussion of Kronig's isthmus:

It is an area of resonance corresponding to the apex of the lung.

It is bounded by

- Anterior border : medial 2/3 of the clavicle.
- Posterior border : Medial 1/3 of the spine of scapula.
- Medial border : a line connecting the sternoclavicular joint in front with 7th cervical spine behind.
- Lateral border : a line joins the anterior point ( junction of medial 2/3 and lateral 1/3 of the clavicle) with the posterior point ( junction of media 1/3 and lateral 2/3 of the spine of the scapula).

Causes of dullness in Kronig's isthmus : consolidation , collapse , fibrosis or pleural thickening in the apex of the lung.




**Anterior view of the external relations of the abdominal thoracic organs**

## IV : Auscultation :

1- Air entry : it is decreased in obstruction of airways , lung collapse , pleural effusion, pneumothorax , or lung fibrosis.

2- Type of breathing :

a-Vesicular breathing :
- Normal breath sounds
- Inspiration is heard longer than expiration
- No pause between inspiration and expiration.

b- Harsh vesicular :
- normal in infants
- it is vesicular breathing but is louder and more harsh
- expiration is heard equal to inspiration

c- vesicular breathing with prolonged expiration :
it is heard in bronchial narrowing as in bronchial asthma.

d- Bronchial breathing :
- Hollow in character
- Inspiration =expiration
- A pause is present between inspiration and expiration.
- It is heard in consolidation as in pneumonia .
- it is normally heard on the trachea.

3- Vocal resonance : effusion.

4- Adventitious sounds :

A- Rhonchi :

i- Sonorous : continuous low pitched sound simulating snoring heard in inflammation of large bronchi and trachea e.g. tracheobronchitis.

ii- Sibilant ( Wheezes) : continuous musical high pitched sounds due to obstruction in small airways . Wheezes may be audible without stethoscope. They are heard in asthma and bronchiolitis.

Wheezes are mainly expiratory (narrowing of the smaller airways ) but may also be inspiratory in more severe cases when the larger airways are also involved . In severe acute attack of bronchial asthma , the obstruction may be so great that air entry is very poor . In such cases , no wheeze is heard ( silent chest). Wheezes are divided into monophonic (single tone or frequency) and polyphonic ( multiple tones or frequencies).

A **monophonic wheeze** is generated by localized narrowing of a single bronchus (as in foreign body), **Polyphonic wheezes** are particularly heard in expiration and are characteristic of diffuse airway obstruction ( as in asthma , bronchiolitis ).

## B- Crepitations ( Rales) :

**i- Fine :** denoting fluid in the alveoli heard late in inspiration they occur in heart failure or early pneumonia.

**ii- Medium sized :** intermittent , bubbling medium pitched sounds :

-heard in early or mid inspiration
-clear with cough
-indicate fluid in bronchioles and bronchi.
-They are of 2 types :

*Consonating* : ( more important ) as in bronchopneumonia or bronchiectasis due to presence of patches of consolidation in the parenchyma.

*Non consonating* : as in bronchitis or asthma where there is no consolidation in parenchyma.

**iii- Coarse :** due to air bubbling through fluid in larger bronchi , heard in bronchiectasis or pulmonary edema.

**C- Pleural rub :** superficial friction sound with to and fro quality , not changed by cough . It is usually associated with pain during deep inspiration. It is due to dry pleurisy.

## D- Transmitted sounds :

In infants and young children , sounds may be transmitted from the upper respiratory tract ( e.g. sounds from the nose or nasopharynx).

To determine if the sounds are transmitted sounds , the stethoscope is put near the mouth of the infant . The same sounds will be heard louder . Transmitted sounds are inspiratory sounds .

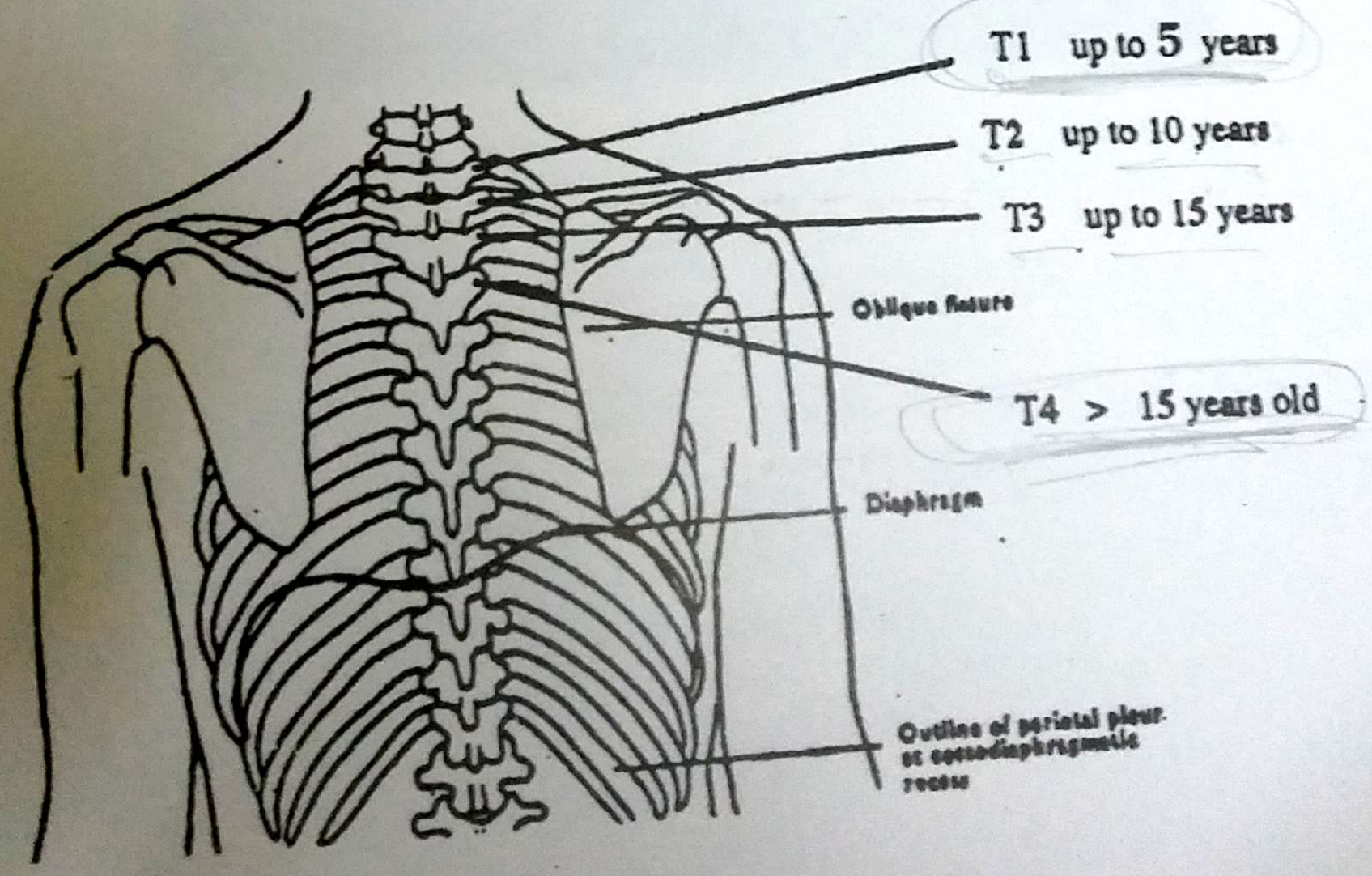
## E- Special Auscultation signs :

**a- Succussion splash :** The stethoscope is put on chest wall and the patient is shaken → A sound of splashing fluid is heard in hydropneumothorax.

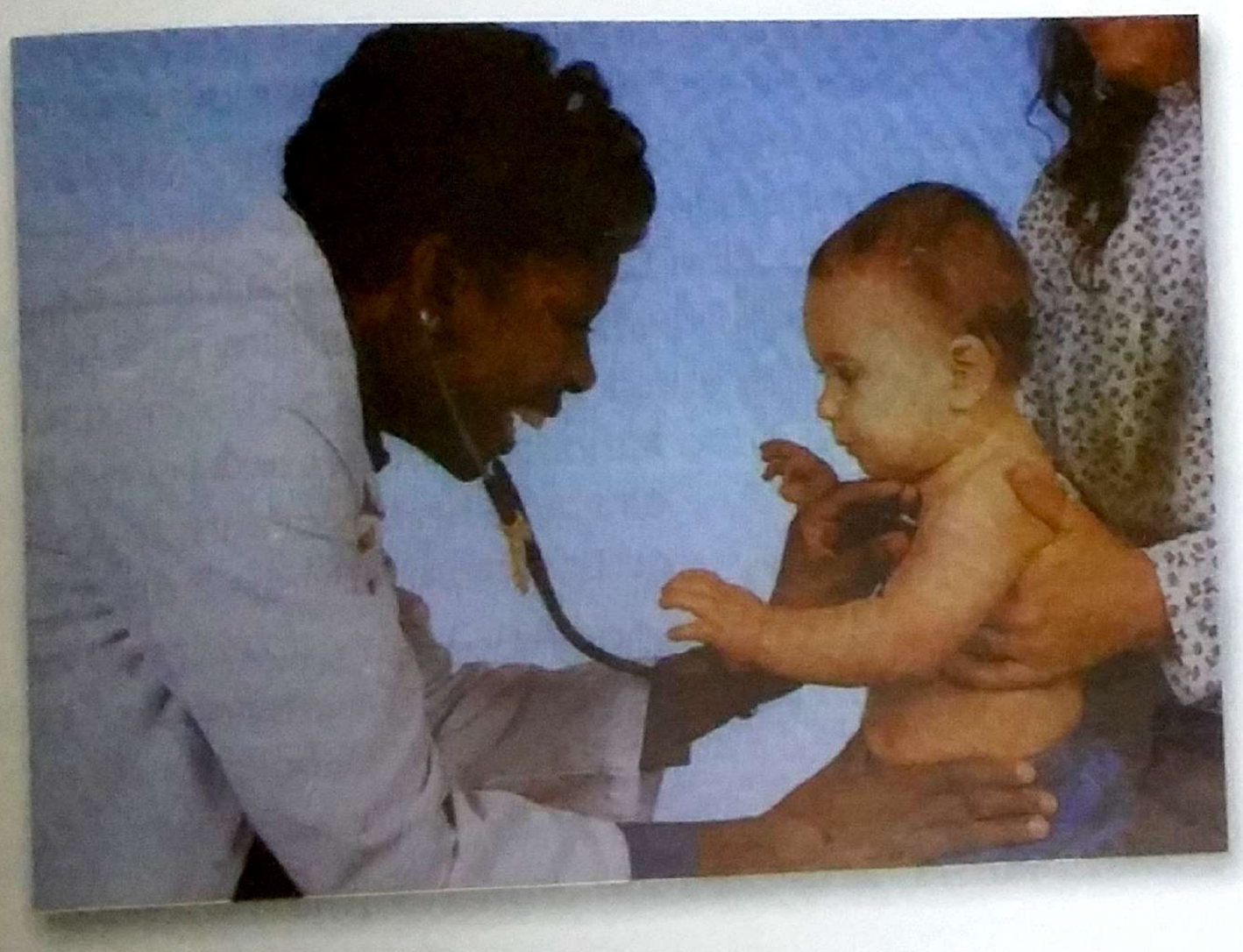
**b- Coin test :** striking 2 silver coins, one of them is in touch with the chest wall → Ringing sound in pneumothorax .

**c- D'Espine sign :**

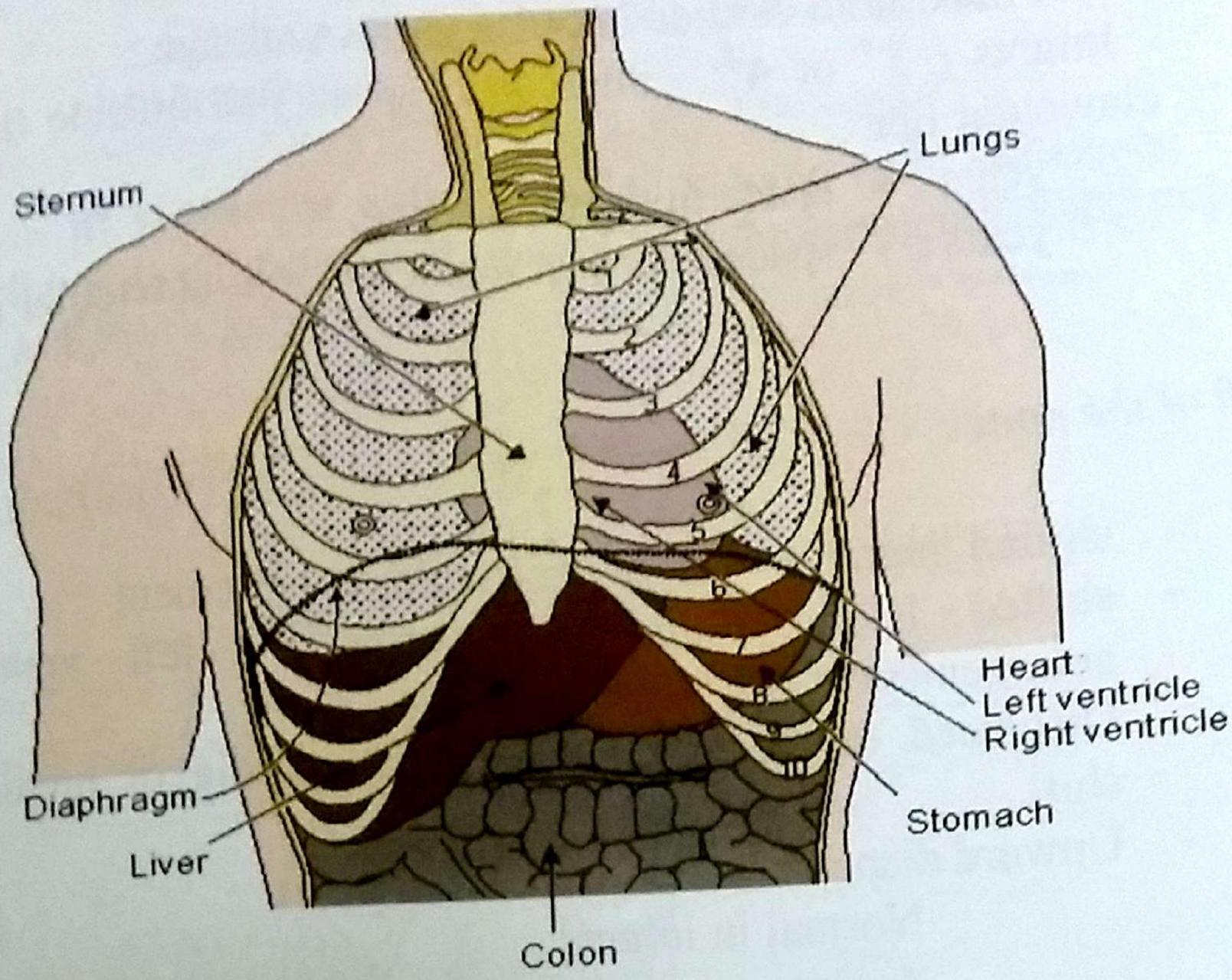
Bronchial breathing is normally heard on the vertebral column . If bronchial breathing is heard below the normal level according to age → +ve D'Espine sign . This denotes enlarged mediastinal lymph nodes which transmit the sounds from the trachea to the chest wall.



# Cardiac Examination



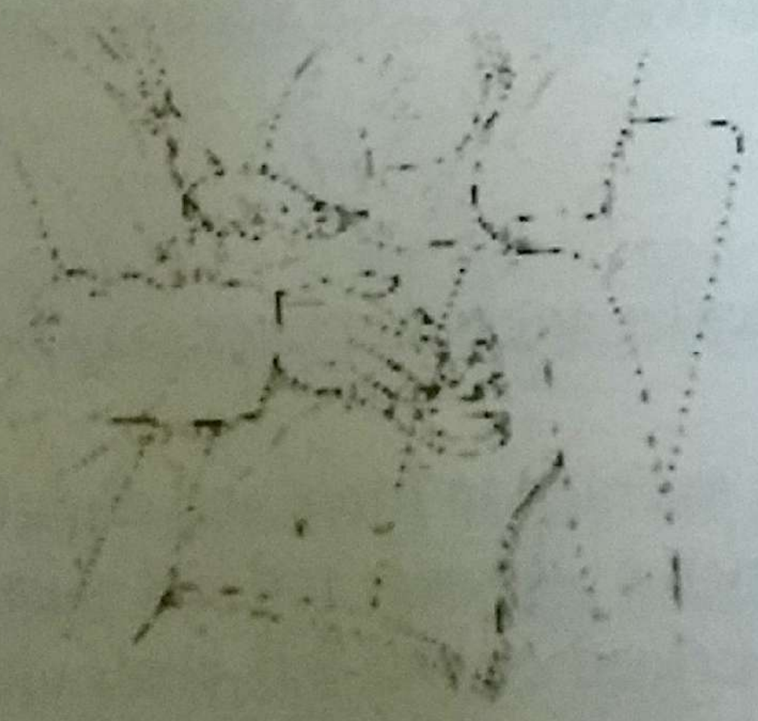
# Cardiac Examination




## I) Inspection and Palpation :

1- Precordial bulge : this denotes long standing cardiac enlargement ( due to cardiac disease in early childhood ) . The precordium is the part of anterior chest wall present in front of the heart ( extending from pulmonary area on the left to aortic area on the right to the lower end of sternum and extending to the apex )

2- Apex beat :



*Detecting the site of apex*

**a- Site :** using the finger tips, locate the point of maximal cardiac impulse which is usually felt at the apex of the heart . The apex is defined as the lowermost and outermost maximal cardiac impulse .

The point of maximum cardiac impulse varies with age :

- Infants : 3rd or 4th intercostal space just outside the mid-clavicular line .
- 2-5 years : 4th space in the nipple line.
- > 5 years : 5th space at or just inside the mid-clavicular line .

*Shift of the apex :*

- shifted laterally → right ventricular enlargement
- shifted laterally and downwards → left ventricular enlargement .
- Displaced to the right side : dextrocardia or mediastinal shift.
- Upward displacement :
  - Normal in infants
  - Ascites
  - Space occupying lesion in the abdomen.

*Invisible apex :* ( if dextrocardia is excluded) , obesity , pericardial or pleural effusion or the apex is behind a rib.

**b- Type :**

-Diffuse apex ( no palpable thrust ) → right ventricular apex ( tapping apex).
- Localized positive thrust : left ventricular apex.

**c- Character :**

i- The left ventricular apex character may be :

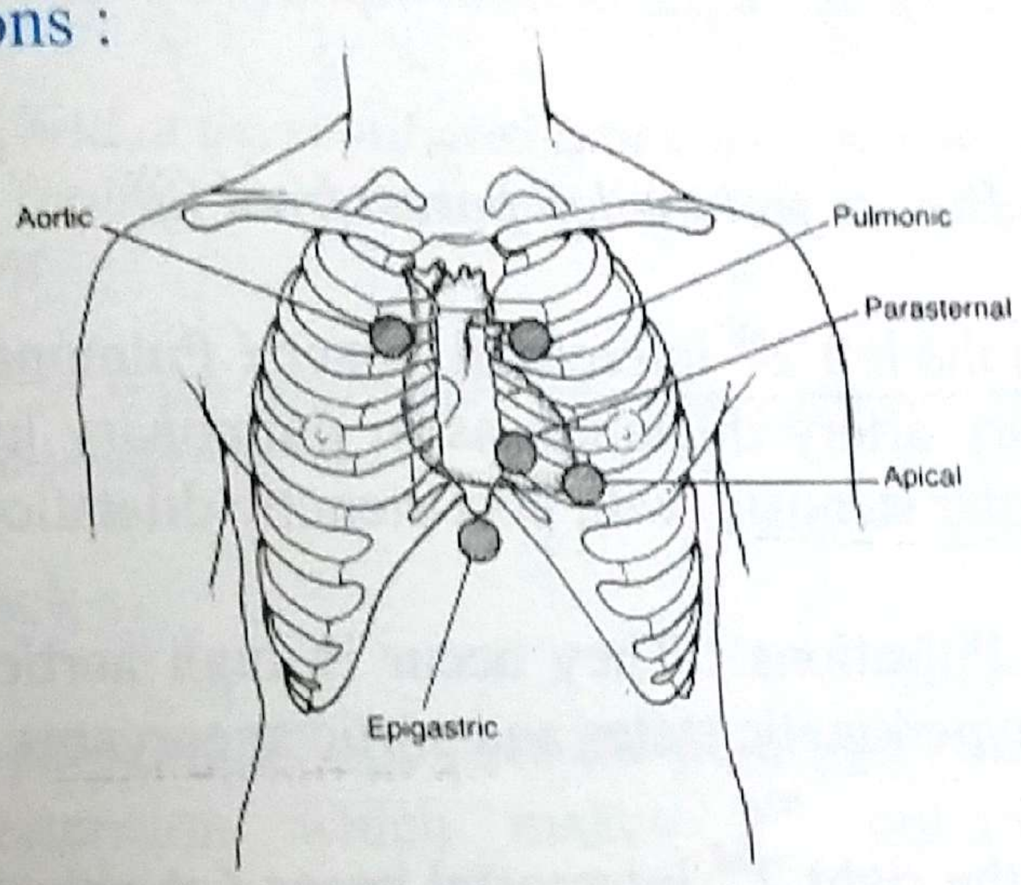
- Normal : average in force and duration.
- Hyperkinetic : strong and not sustained . It occurs in volume overload on the left ventricle as in VSD , PDA, Aortic or mitral valve incompetence. It occurs normally

in muscular exercise and in hyperkinetic circulation e.g. thyrotoxicosis or anemia.

- Heaving apex : strong and sustained . This occurs in pressure overload on the left ventricle e.g. aortic stenosis.
- Slapping apex : palpable first heart sound in Mitral valve stenosis.

ii- Rt ventricular apex is called tapping apex where no +ve thrust is palpable. It is present in right ventricular hypertrophy as Fallot's tetralogy.

## 3- Other pulsations :




*Sites of pulsations in cardiac examination*

A- Epigastric : which may be :

i- Aortic pulsations : in thin individuals , aortic aneurysm or transmitted through tumors in front of the aorta.

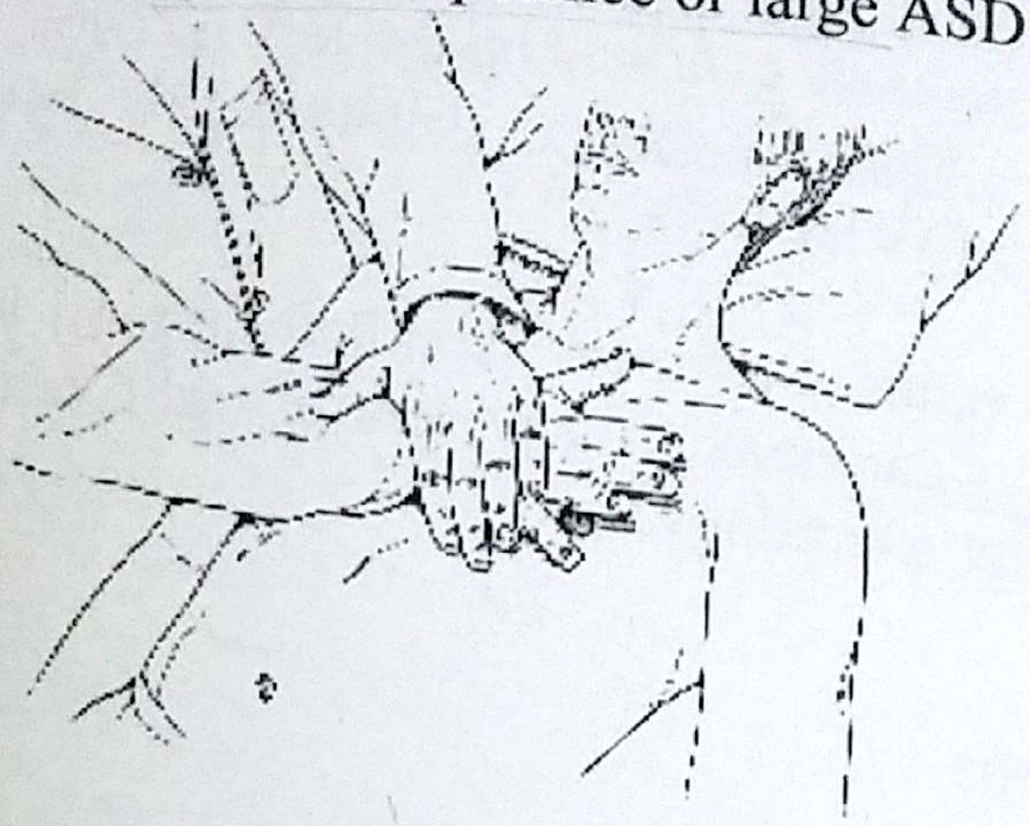
ii- Right ventricular due to right ventricular enlargement .

iii-Hepatic :due to distensible pulsation of the liver in tricuspid regurgitation .

B- Left parasternal pulsations in the left 3rd and 4th intercostal spaces: They denote right ventricular enlargement .

- if strong and sustained ( called left parasternal heave ) → pressure load on right ventricle leading to its hypertrophy as in pulmonary stenosis or pulmonary hypertension.

- If strong and not sustained ( called left parasternal lift) → volume load on the right ventricle as in tricuspid or pulmonary valve incompetence or large ASD .



*How to feel the left parasternal lift*

C- Pulsations in the left 2nd intercostal space ( Pulmonary area) : they denote pulmonary artery dilatation as in pulmonary hypertension or pulmonary valvular stenosis (with post-stenotic dilatation).

D- Suprasternal Pulsations : They occur in high aortic arch , aortic incompetence , hyperkinetic states and aortic aneurysms.

E- Pulsations in the right 2nd intercostal space ( Aortic area) : due to aortic dilatation caused by aortic valve incompetence or stenosis (with post-stenotic dilatation )or aortic aneurysms ( rare in children)

F- Pulsations in right parasternal area : due to marked enlargement of the right atrium.

4- Thrills : the palmer surface of the hand at the base of the fingers is more useful for detecting thrills . Thrills are palpable murmurs. Presence of thrill means presence of murmur which is organic ( not functional ) and of high grade intensity ( usually > 3/6 ).

***Comment on the thrill :***

- Site of maximum intensity e.g. left 3rd and 4th spaces parasternally in VSD or on the carotid artery at the neck → in aortic stenosis.

- Time of thrills : systolic or diastolic . Thrills felt at the base of the heart are usually systolic ( pulmonary or aortic stenosis) , while thrills felt at the apex are usually diastolic as in mitral valve stenosis .

In VSD , a systolic thrill is felt at the left parasternal area.

*-N.B. Thrill at the mitral area is best felt when the patient lies on his left side .Thrill at the base is best felt when the patient is sitting and bent forward .*

*- N.B. to make thrills more apparent , examine the patient after doing muscular exercise.*

## 5- Diastolic shock :

It is palpable 2nd sound in the pulmonary area due to pulmonary hypertension which makes 2nd pulmonary heart sound accentuated.

To examine for diastolic shock, the patient sits in bed , leans forwards and stops breathing in full expiration ( needs cooperative child) while the examiner puts the ulnar side of his hand in the 2nd left space.

## II. Percussion :

Percussion is used to assess the size of the heart by outlining cardiac borders. It is a difficult technique and has limited usefulness in infants and young children.

### A) The upper border :

1- Percussion is done in the parasternal lines , in the first 3 intercostal spaces, comparing between the right spaces .

2-In infants the left 2nd intercostal space is impaired or dull.
In children , dullness usually starts in the left 3rd intercostal space .

**The causes of dullness in the 2nd left space include :**

- normal in infants
- pulmonary artery dilatation as in pulmonary hypertension.
- Pleural effusion
- Pericardial effusion
- Mediastinal tumors
- Consolidation , collapse or fibrosis of left lung.

### B)The right border:

1-Detect the site of upper border of the liver by percussion in the right mid-clavicular line .

2-Percuss the right border of the heart , starting in intercostal space above the upper border of the liver and the left hand is perpendicular to the ribs i.e. parallel to the sternum. Percuss from outside inward towards the heart .

Normally, there should be no dullness outside the right border of the sternum.

Dullness outside the right sternal border occurs in :

a- Right atrial enlargement in tricuspid valve lesions or pulmonary hypertension.
b- Pericardial effusion .
c- Enlarged heart in cardiomyopathy.

C) The left border : outside de apex

Percussion is started in the left mid-axillary line in the same space of the apex with the left hand oblique so that it is parallel to the left border of the heart . Percussion proceeds from the mid-axillary line to the site of the apex. There should be no dullness outside the site of the apex.

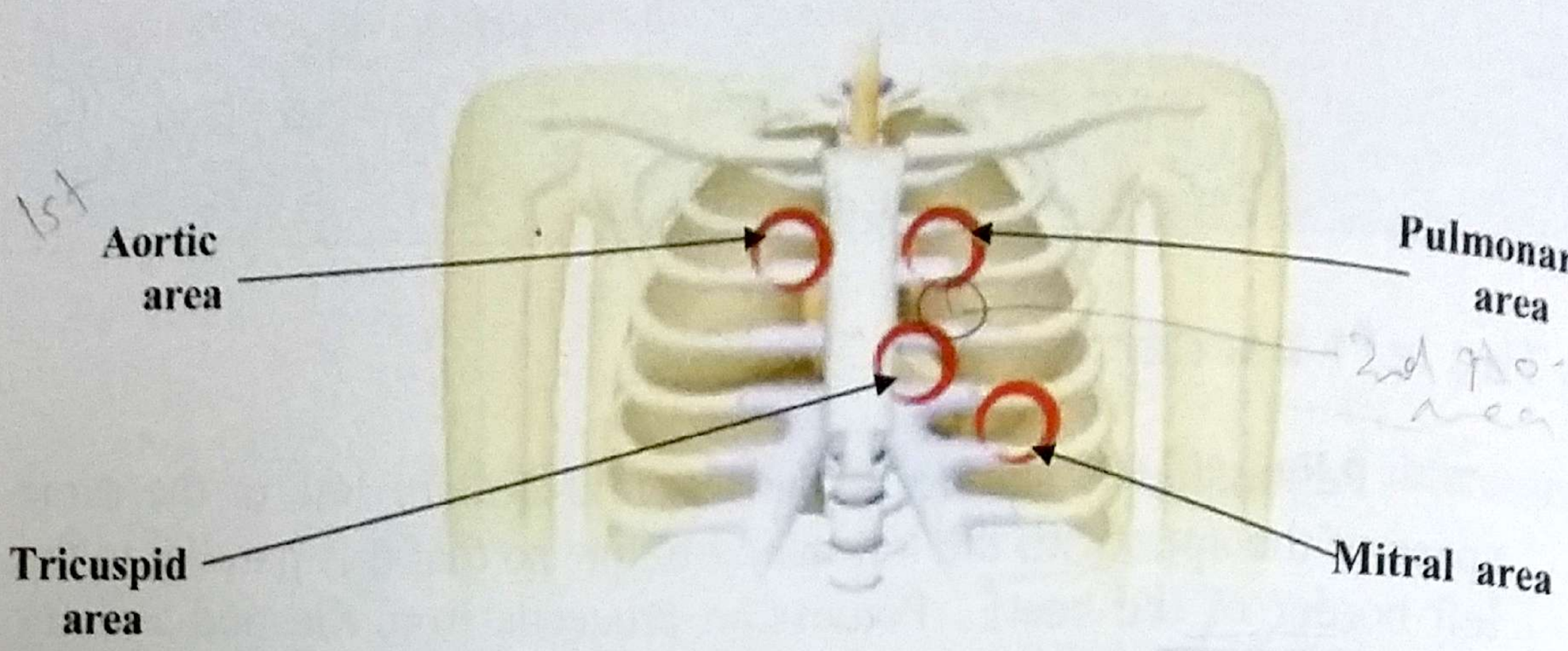
Dullness outside the apex occurs in :

- pericardial effusion
- left pleural effusion
- left lung consolidation, collapse or fibrosis .

D) Percussion of the lower half of the sternum :

-By direct percussion
-Normally, it should be resonant . If dull , this is an indication of right ventricular enlargement as in pulmonary stenosis or pulmonary hypertension .

## III: Auscultation :




Auscultatory Areas

**General considerations :**

1-Closure of the atrioventricular valves ( mitral and tricuspid valves ) produce the first heart sound and thus mark the start of systole .

2-Closure of the semilunar valves ( pulmonary and aortic vavlves) produce the second sound and thus mark the start of diastole .

3-Ausculatatory areas are :

-Mitral area : is the site of apex
-Pulmonary area : 2nd left intercostal space in the parasternal line
-Aortic areas :

1st aortic area : 2nd right intercostal space in parasternal line.
2nd aortic area : 3rd left intercostal space in parasternal line.

-Tricuspid area : lower end of left sternal border .

4- The first heart second is best heard at the apex and at the tricuspid area . The aortic component of the second sound is best heard on the aortic area ( 2nd right intercostal space) while the pulmonary component of

the second second is only heard at the pulmonary area and is not heard at all in the aortic area.

5- On auscultation of the heart , the following items should be commented on :

- Heart sounds : 1st and 2nd
- Additional heart sounds e.g. 3rd heart sound
- Murmurs
- Pericardial rub.

## 1) Heart Sounds :

### A- First heart sound :

- Distant or inaudible : in obesity , pleural or pericardial effusion or hyper- inflated lungs.
- Muffled (masked) by pansystolic murmur as in mitral valve incompetence. MR
- weak : in rheumatic mitral valve incompetence, and in myocaridits.
- Accentuated :
  - Mitral stenosis.
  - Tachycardia in muscular exercise ,fever and anemia.

### B- 2nd heart sound :

- Weak or inaudible : in aortic or pulmonary stenosis.
- Accentuated :
  - Aortic component : systemic hypertension
  - Pulmonary component : pulmonary hypertension.

- Splitting of the 2nd sound :

Normally , closure of the pulmonary valve follows that of the aortic valve , so there is splitting of 2nd sound.
The normal splitting is (1) heard in the pulmonary area only and (2) during inspiration only :

a- Heard on pulmonary area only because the aortic and pulmonary components are heard on the pulmonary area but at the aortic area , the aortic component only is heard.

b- During inspiration only because during inspiration , the venous return increases to the right side with consequent increase in blood volume pumped by right ventricle → increase duration of right ventricular systole →delayed closure of pulmonary valve → evident splitting .

Abnormalities in Splitting of second sound on Pulmonary area:

a-Wide fixed splitting of the second sound : in ASD ( *due to the presence of increased volume load on the right ventricle constantly during inspiration and expiration*).

b-Absent splitting ( single second sound on the pulmonary area):

1. Severe pulmonary stenosis
2. Fallot's tetralogy .
3. Severe aortic stenosis
4. Transposition of the great arteries ( *because of abnormal position of the pulmonary artery which is situated behind the aorta away from the chest wall , so the pulmonary component is not heard*).

c-Reversed splitting ( *aortic component follows pulmonary component and splitting is evident in expiration* ): in

- aortic stenosis
- left bundle branch block.

## 2- Additional heart sounds : e.g. 3rd heart sound .

It is caused by rapid descent of blood from atria to the ventricles . It is considered normal in children ( if heard).

It is best heard inside the apex with the patient in lateral position , during expiration using the bell of the stethoscope. It is heard in diastole.

## 3- Murmurs : comment on murmurs should include :

a. Timing :

Systolic : pan , ejection or late
Diastolic : early , mid or late ( pre systolic)
Continuous.

b. Site of maximal intensity

Very important as it detects the site of origin of the murmur.

c- Propagation : e.g to axilla or all over the precordium

d-Character : soft , harsh, blowing , rumbling , or musical

e- Grade ( 6 grades ):

Grade 1 : very faint , may be not heard in all positions. It needs a quite room..
Grade 2 : weak but heard immediately when the stethoscope is placed on the chest .
Grade 3 : moderately loud.
Grade 4 : Loud , a thrill can be palpated.
Grade 5 : Very loud , may be heard with a stethoscope partly off the chest.
Grade 6 : can be heard without a stethoscope by putting the examiner 's ear near the chest of the patient

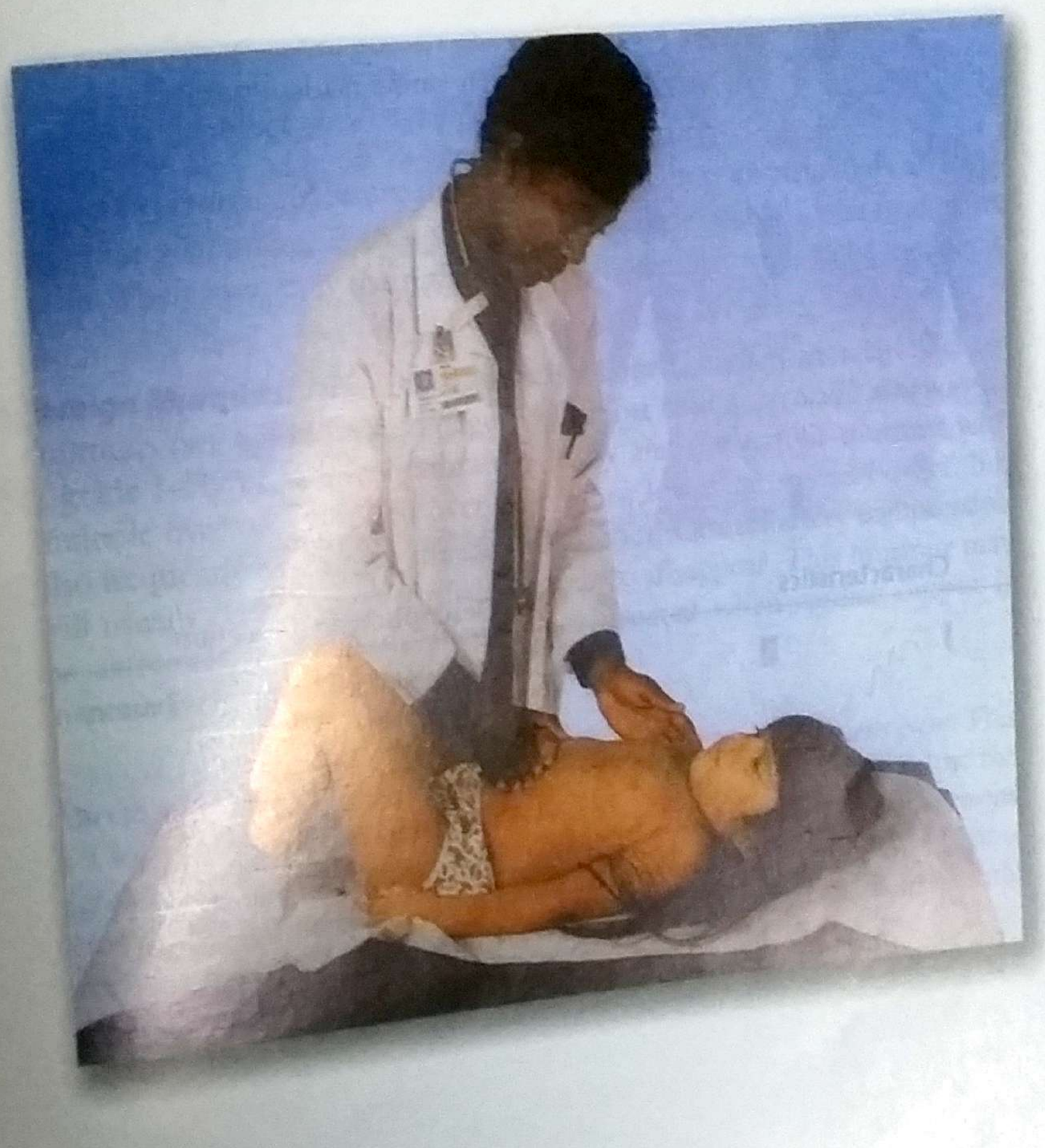
f- Effect of respiration or change in position :

Listen to the heart both in supine and sitting or standing position and during expiration and inspiration and in addition, determine changes induced by exercise. These maneuvers help in diagnosis of certain conditions as mitral valve prolapse and subaortic stenosis .

## 4. Pericardial rub :

-Scratchy superficial sound with to and fro quality.
- best heard at the lower part of left sternal border.
- not related to heart sounds
- increase in intensity by leaning forwards or when you press with the stethoscope.
- It occurs in pericarditis ( rheumatic , viral , septic , tuberculous, other collagen diseases or uremia).

# Abdominal Examination



# Abdominal Examination:

## I-Inspection :

### 1) Abdominal contour :

Normally, the abdomen has the appearance of pot belly until the child reaches puberty.

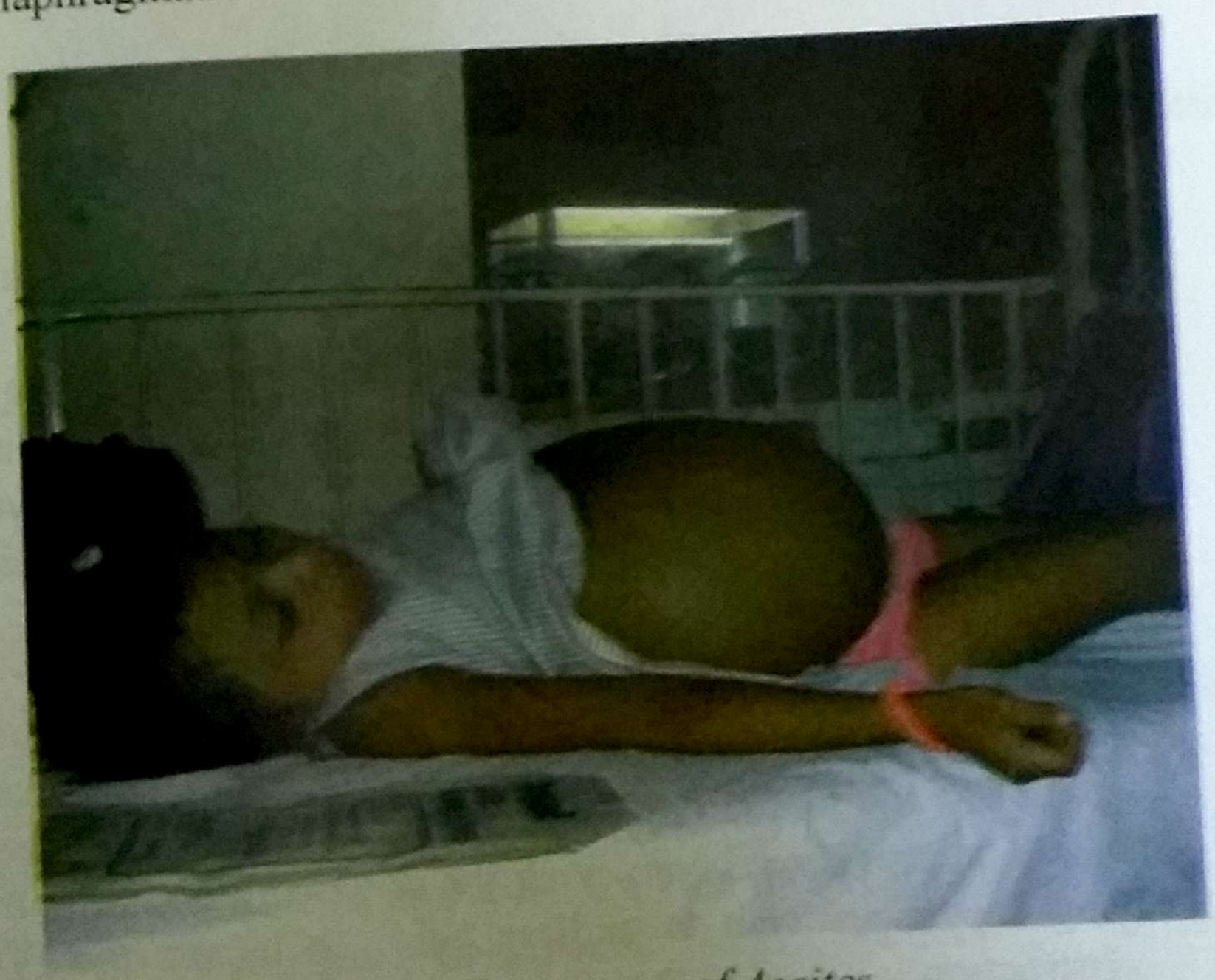
*Abnormally distended abdomen :*

a- Localized : abdominal mass ( enlarged organs or tumors ).

b- Generalized :

- Constipation.
- Gas distension of the bowel.
- Ascites.
- Organomegaly as hepatosplenomegaly.
- Tumors as Wilm's tumor.
- Hypotonia of abdominal muscles in rickets , hypothyroidism or hypokalemia.
- Bowel obstruction or ileus.
- Paralysis of abdominal muscles.

*Scaphoid abdomen* : in dehydration, severe PEM as marasmus, diaphragmatic hernia in the newborn or high intestinal obstruction.



*Severe case of Ascites*

2) Subcostal angle : right angle : normal
Obtuse angle : hepatomegaly, splenomegaly or ascites.
Narrow angle : in pigeon breast deformity.

3) Suprapubic region : full in distended urinary bladder or tumors.

4) Skin : examine for :
- Rashes ,
- Scars : e.g. scar of splenectomy ,
- Striae ( due to tear of elastic fibers in subcutaneous tissue. The causes are ascites, obesity, Cushing disease or corticosteroid therapy).

*Striae due to steroid therapy*

- Dilated superficial veins :

a- Thin veins over the costal margins are common and usually of no significance.

b- **Dilated veins around the umbilicus (Caput medusae ),** signify portal hypertension. These veins represent opening of anastomosis between portal and systemic veins around the umbilicus. The direction of the blood flow in these veins is away from the umbilicus .

c- **Dilated veins in obstruction of IVC:** these veins represent dilated anastomotic channels between the superficial epigastric and circumflex iliac veins below and the lateral thoracic veins above, conveying the diverted blood from the long saphenous vein to axillary vein to bypass the IVC obstruction .

These veins appear at the sides of the abdomen and the direction of blood flow is upwards

**In SVC obstruction,** the dilated veins appear also at the sides of the abdomen but the flow is in the opposite direction ( i.e. downwards).

**How can we detect the direction of blood flow in dilated superficial veins of the anterior abdominal wall ( i.e. to differentiate between portal hypertension and IVC obstruction ?**

a- A dilated vein below the umbilicus is chosen for examination.

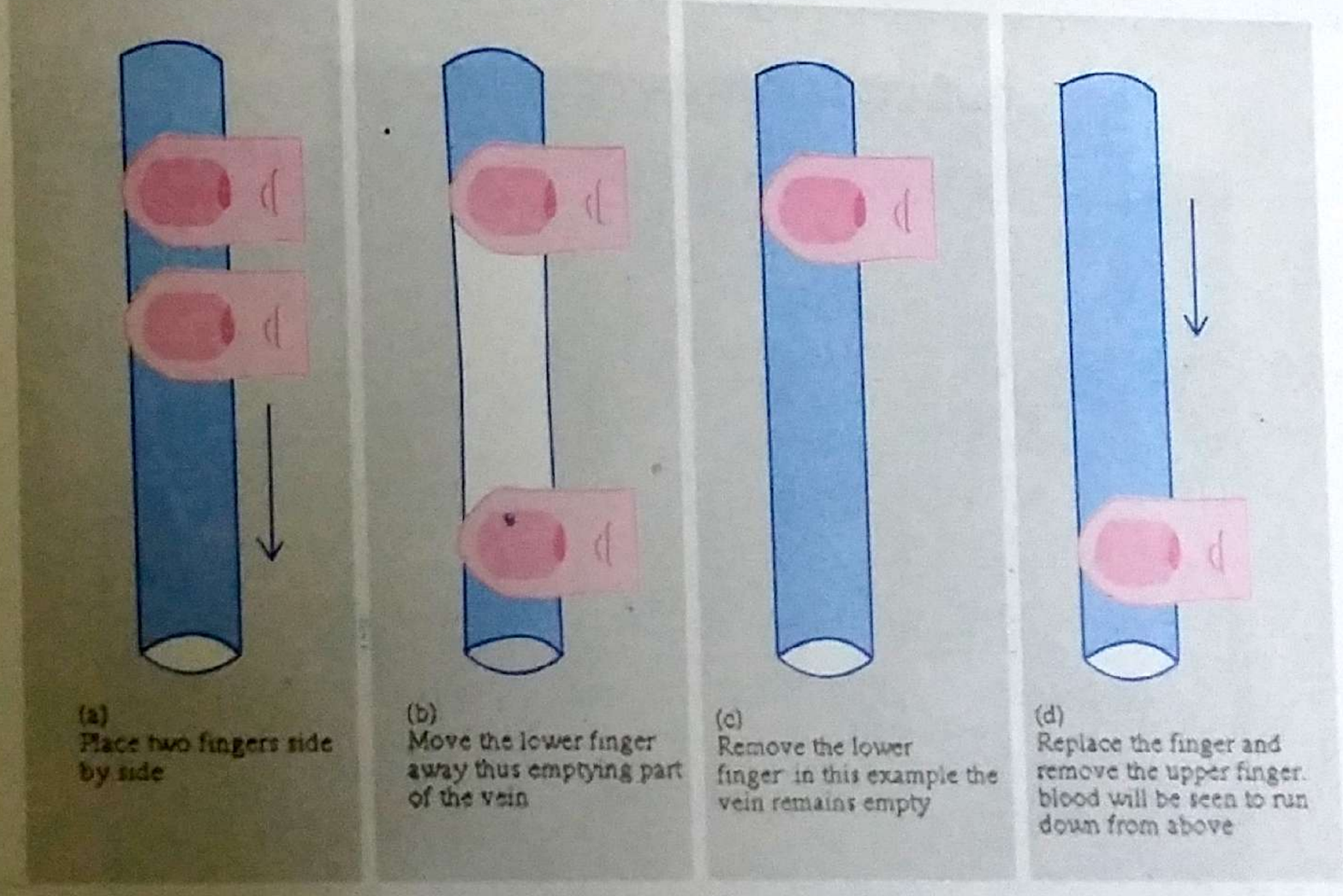
b- Place 2 fingers side by side pressing on the vein.

c- Move the lower finger away ( while pressing on the vein) so that emptying a part of the vein occurs.

d- Remove the lower finger and see if the vein fills or remain empty.

e-Repeat the steps b, c again but remove the upper finger instead of the lower and see if the vein fills.

The direction of filling of the vein will be evident if it is upwards ( IVC obstruction) or downwards ( in portal hypertension )



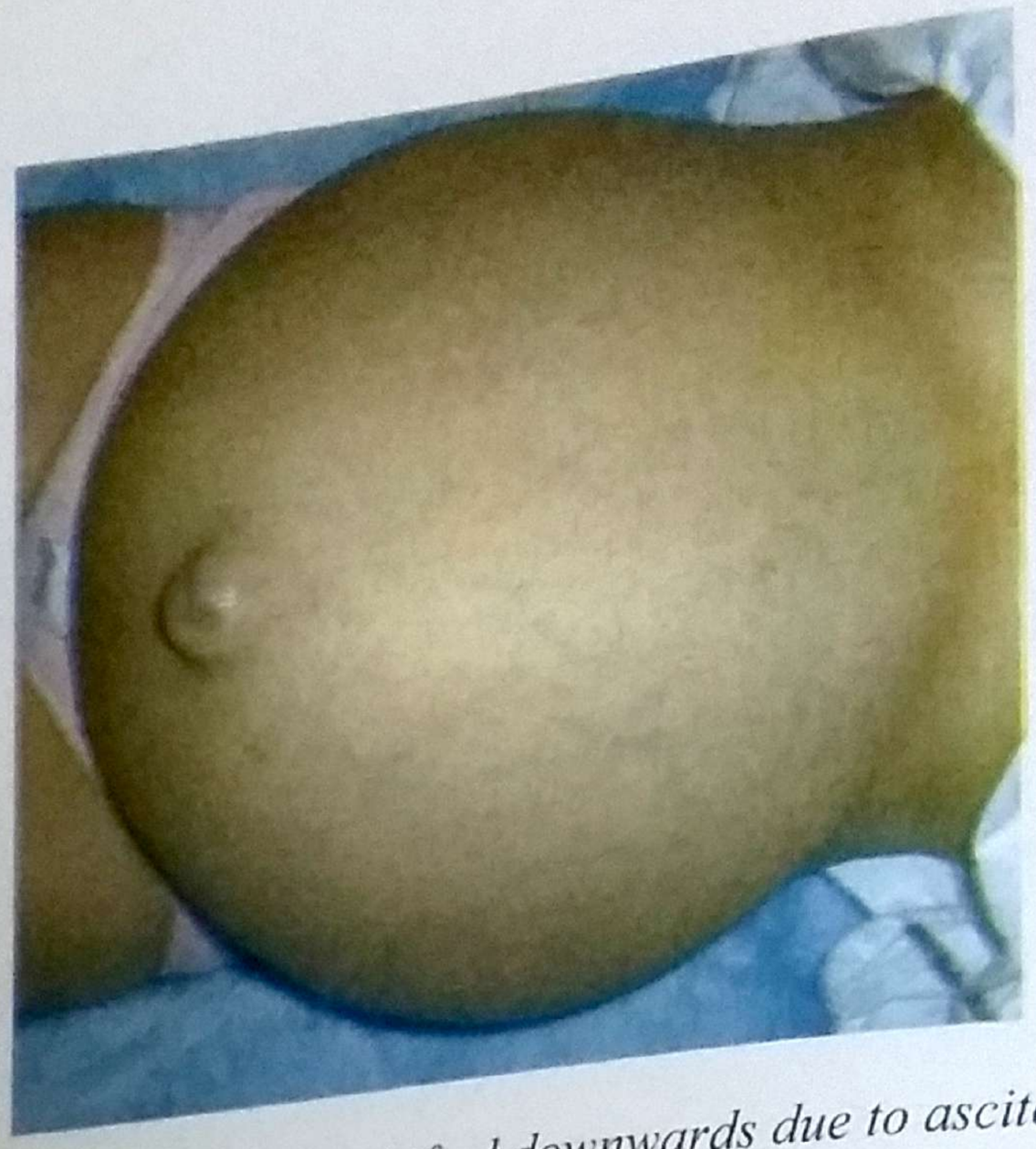

## 5) Umbilicus :

Shape : normally inverted . Everted umbilicus is seen in ascites.

Site : normally midway between xiphoid process and symphysis pubis.

-Shifted upwards : e.g. tumors of the pelvis

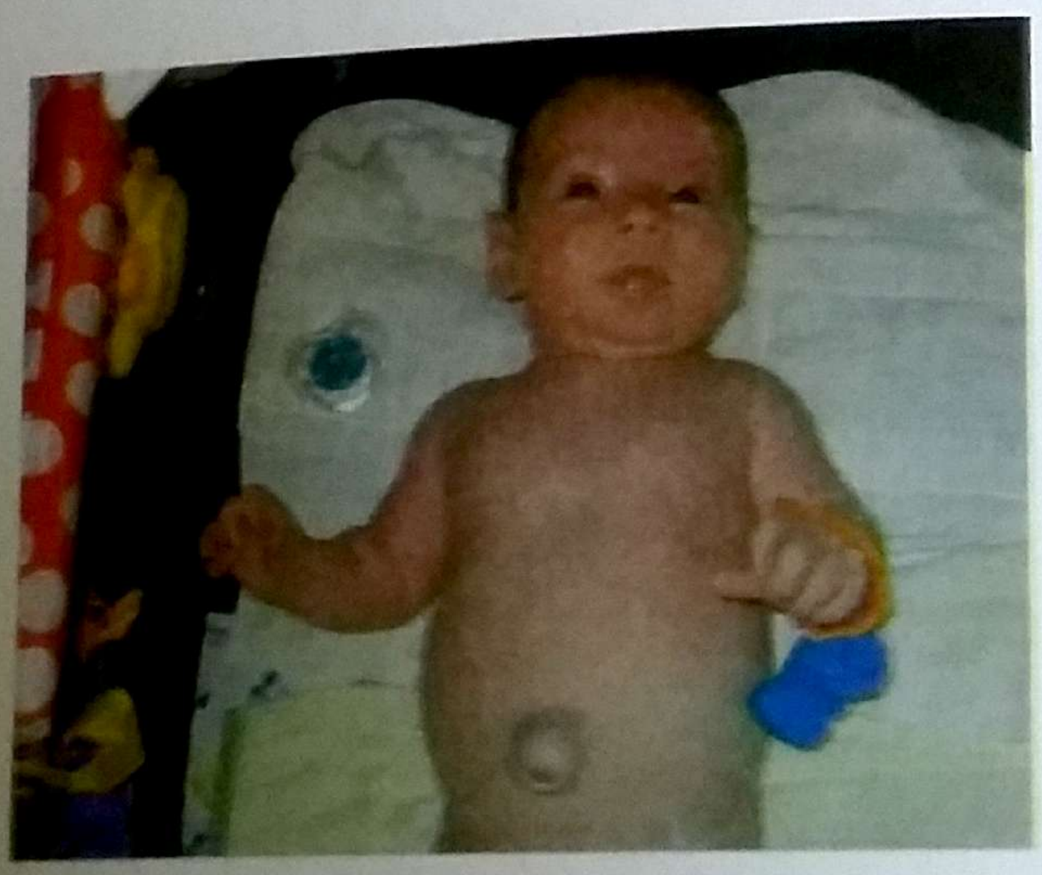
-Shifted downwards e.g. ascites , tumors or organomegaly in the upper abdomen.



*Everted umbilicus , shifted downwards due to ascites*

Umbilical hernia : becomes more prominent with crying. It is common in normal infants , Down syndrome and cretinism.

Abnormal discharge : e.g. urine or fecal matter in umbilical polyp caused by patent urachus or omphalo-mesenteric duct.



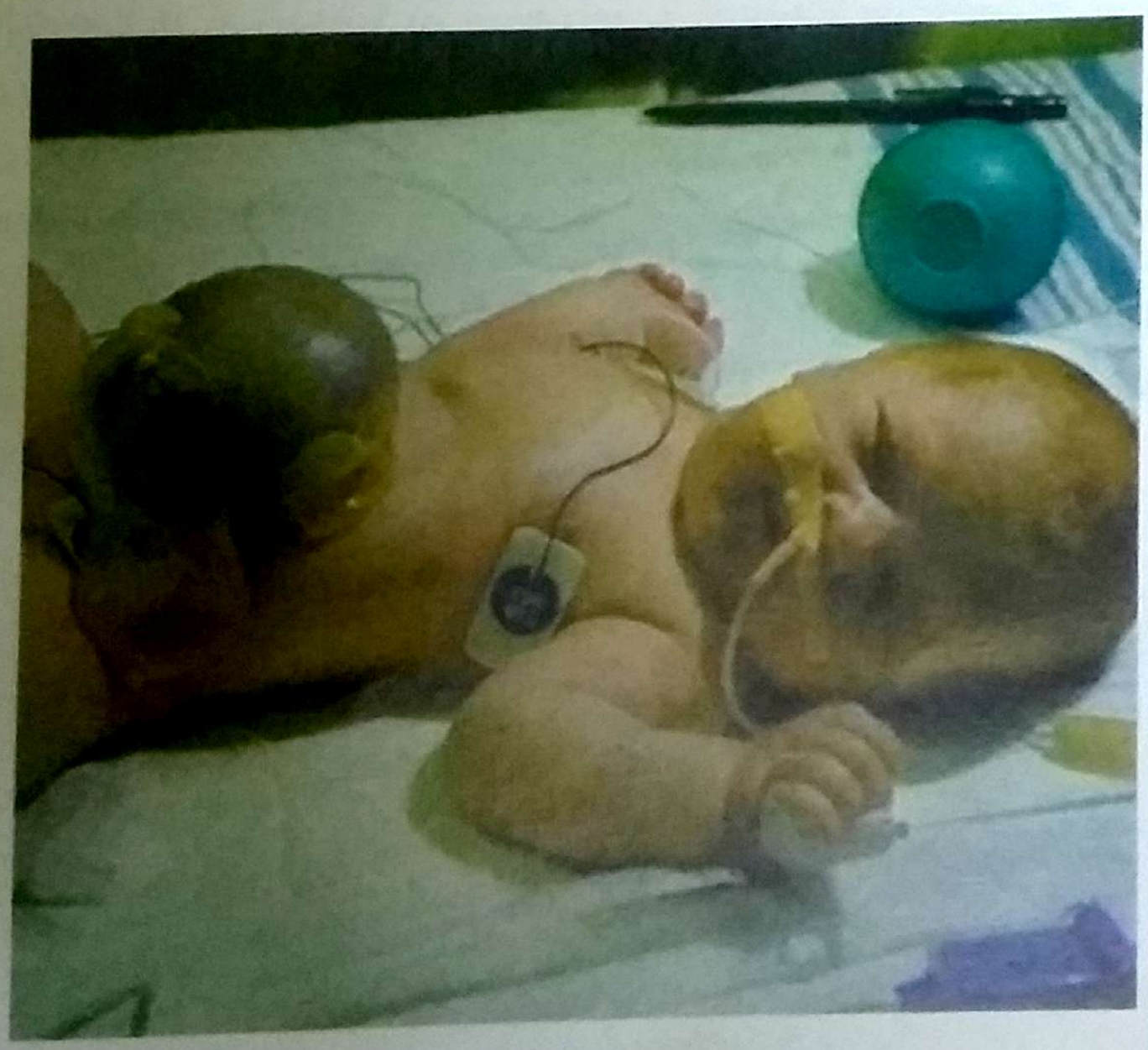
Umbilical hernia

Umbilical granuloma : a granulating area caused by low grade infection in the region of the umbilical stump. It appears as moist soft , red or pink mass that ooze a seropurulent discharge.

Omphalitis : Inflammation of the umbilicus usually bacterial as streptococcus pyogenes.


*Umbilical granuloma*

*Omphalitis*



Omphalocele : Defect in the muscles of anterior abdominal wall leading to protrusion of the intestine ± other abdominal organs into a sac formed by the peritoneum.

6) Divarication of the recti : may be normal or due to weakness of the musculature of anterior abdominal wall or chronically distended abdomen.

7) Respiratory movements :
Respiration is largely abdominal in children below 6 years of age .

Absent movements of abdomen :
- Peritonitis
- Appendicitis
- Paralytic ileus
- Diaphragmatic paralysis
- Large amount of ascitic fluid.
- Large amount of abdominal gases.

8) Hernial orifices : important in any case of acute abdomen or abdominal colic to exclude strangulated hernia.

9) Intestinal movements : visible peristalsis could be seen in thin infants especially prematures. Otherwise , intestinal obstruction should be excluded.

10) Back : see examination of the back.

## II.Palpation :

*Guidelines :*

*1- For good palpation , make the child feel relaxed to avoid muscle guarding and look at the child's face to detect if there is tenderness during palpation .*

*2- Make sure you have your fingernails trimmed , your hand is warm and the child is comfortable .*

*3- Palpate with the cushion of the fingers rather than the tips.*

*4-If the child is cooperative , he can be asked to take deep breaths and flex the knees during this part of examination.*

*5-In a crying child , distinguish between a soft and hard abdomen and palpate abdominal organs immediately on inspiration when the child relaxes the abdominal wall for an instant.*

*6- Keep the fingers of your right hand straight with slight flexion.*

*7- Tender areas are the last to be palpated.*

1) Superficial Palpation : it is done to :

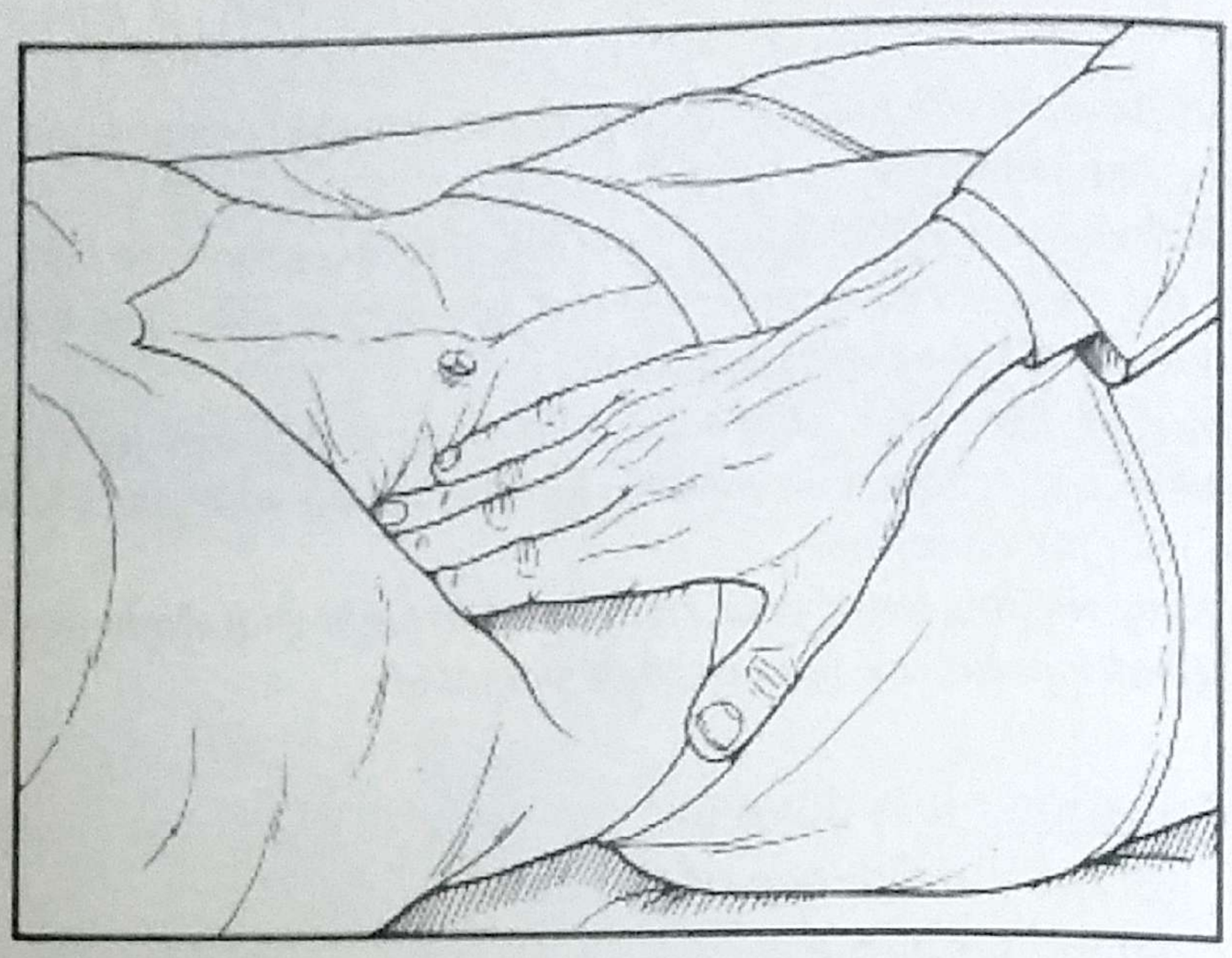
a- get the confidence of the child.
b- detect tenderness.
c- detect rigidity.
d- detect hotness.
e- detect superficial masses.

***Technique :*** *It is useful to perform a logical routine in palpating the abdomen e.g. Start in the left iliac region , go anticlockwise to end in suprapubic region. Gently palpate each quadrant noting for rigidity, tenderness or superficial masses.*

2- Deep palpation : to feel organs and masses i.e. liver, spleen , both kidneys and urinary bladder . Palpate deeply for retroperitoneal structures in the abdomen . Palpate also the groins and examine genitalia

# Palpation of the abdominal organs :

**1- Liver :** In normal infants, the liver is palpable up to 2 cm below the right costal margin with rounded border and soft consistency. In the newborn , the liver edge may be normally felt 3.5 cm below costal margin.



**Technique :**

1-Place the palm of right hand parallel to the right costal margin. Start in the right iliac region and proceed upwards . Ask the child to breathe deeply ( if cooperative ) . At the height of inspiration (as the liver is pushed down) press the fingers firmly inwards and upwards. If the liver is palpable , it will be felt by the radial border of the index finger. *NB : in neonates and young infants, the examiner can not put the whole palm of the hand on the abdomen due to the small area of anterior abdominal wall, he can use only 2 fingers instead.*

2- In severe ascites, the liver is palpated by the dipping method. Thrust the tips of the fingers quickly but gently into the abdomen so as to feel the organs when the ascitic fluid is displaced

## Comment on :

a- Size : The right lobe ( in centimeters below the costal margin in MCL ).
The left lobe ( in centimeters below the xiphisternum in midline ).

b- Lower border :
Rounded : in acute inflammation or congestion
Sharp : in fibrosis or cirrhosis.

c- Surface : smooth or nodular.
d- Consistency : soft , firm or hard.
e- Tender or not .
f- Pulsating or not.
g- Upper border : by percussion at mid-clavicular line ( normally present in the 5th intercostals space in MCL ).
**h- The liver span :** to assess liver size = distance between upper border of the liver by percussion and lower border in the mid - clavicular line. Increased liver span means enlargement and not ptosis of the liver.

| Average Liver Span | |
|---|---|
| Age ( years) | Span ( cm ) |
| 1 | 6 |
| 2 | 6.5 |
| 3 | 7 |
| 4 | 7.5 |
| 5 | 8 |
| 12 | 9 |

Important causes of hepatomegaly :

-Congestion in heart failure , pericardial effusion or Bud Chiari disease.
-Hepatitis
-Tumors
-Blood diseases as thalassemia
-Metabolic diseases e.g. glycogen storage disease.

**2- Spleen :** it may be felt 1-2cm below the costal margin in infants and young children.

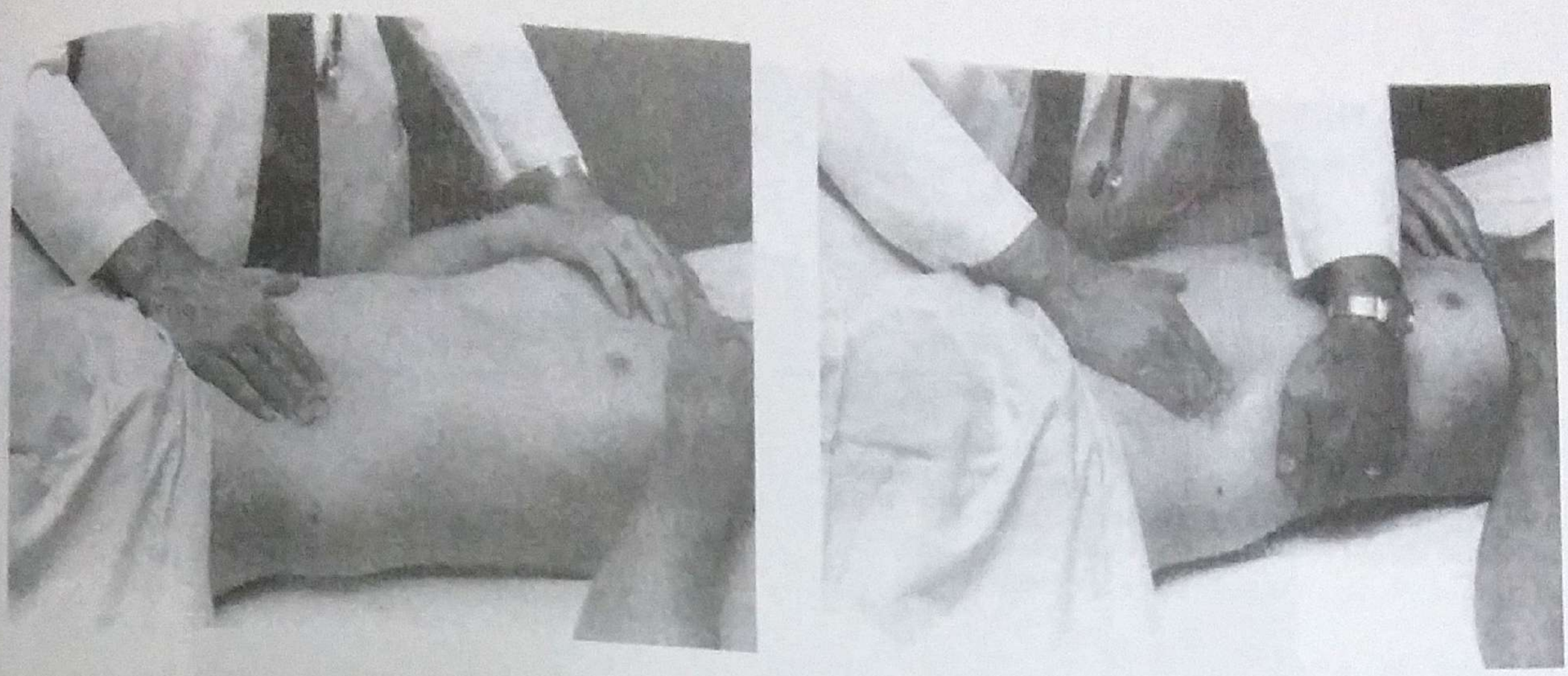
***Methods of palpating the spleen :***

A- Classical method :

Palpation for splenic enlargement should begin with the patient supine and with knees flexed. Using the right hand, the examiner should begin well below the left costal margin ( starting from the right iliac region) and feel gently but firmly for the splenic edge by pushing down, then cephalad, then releasing .This maneuver should be repeated, working toward the left costal margin.

If the spleen cannot be felt below the left costal margin with the patient breathing quietly, the left hand should be placed behind the left lateral ribs and the right just below the left costal margin . The child, if cooperative , is asked to inspire deeply. The examiner's right hand should then repeat the maneuver of pressing down, cephalad, and releasing.

Repeat the palpation starting from the left iliac fossa in the same way . Make sure to palpate below the left costal margin in its medial and lateral parts. If the spleen is palpable it should come and touch your hand as a soft or firm swelling during the phase of inspiration.

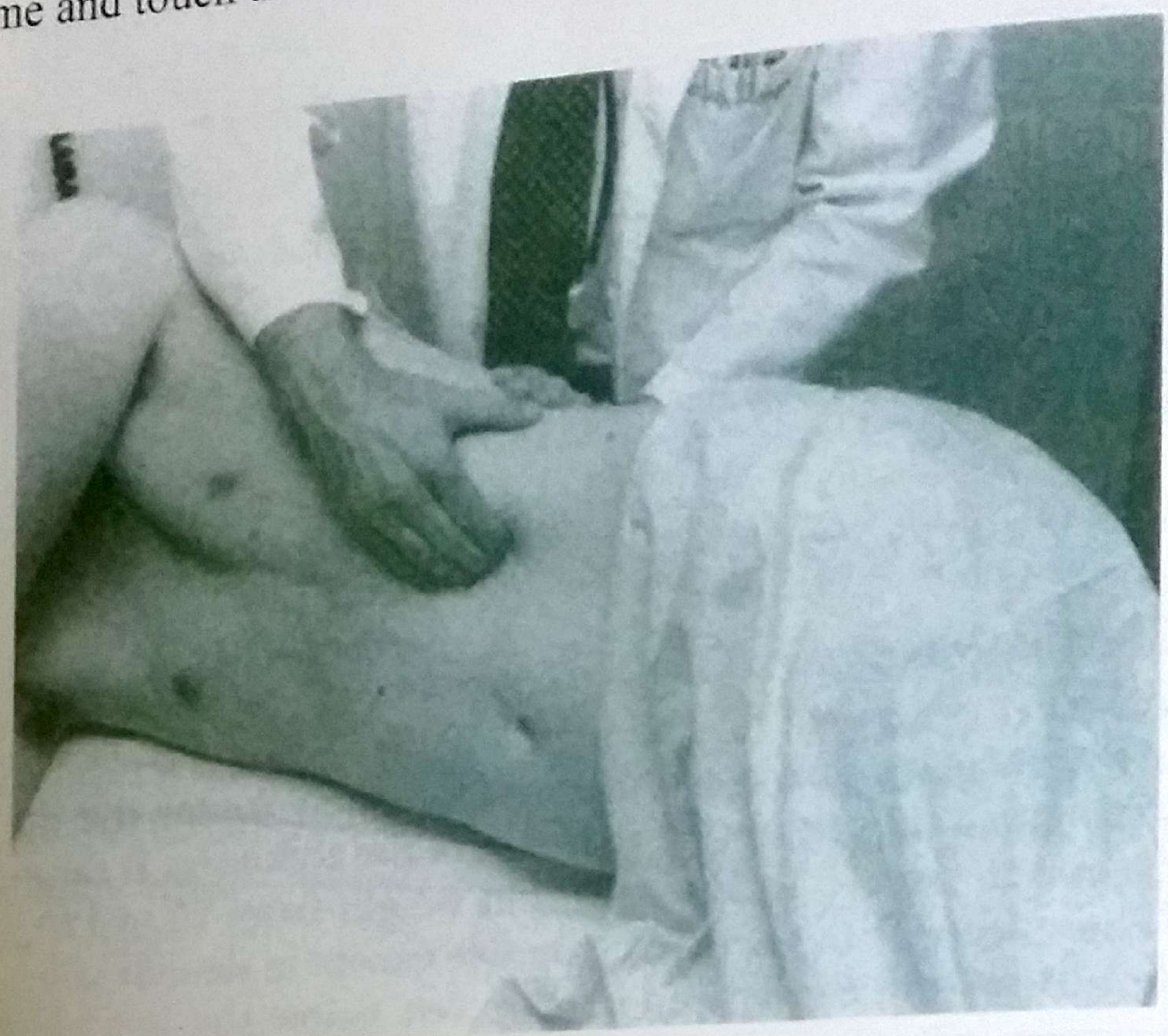


*Classical method of palpating the spleen*

**B- Short's Manoeuvre :** *used if the spleen can not be palpated by the classical method.* Turn the child to the right lateral position and put the left hand on the left lower ribs. Place the right hand lightly over the abdomen below the left costal margin . As the child breathes deeply the spleen tip should just touch the tip of the fingers.

**C-Hooking method :** The examiner can sit on the left side of the supine child and place the right palm on the left costal margin with the fingers hooked over the costal margin , and the child breathes deeply if possible . The hooking method can be performed while the patient is lying in right lateral position and the examiner's left hand

supports the left lower ribs (as seen in the picture) . The spleen should come and touch the examiner's hand, if it is palpable.



*Hooking method in right lateral position*

D- Dipping method : if there is severe ascites . It is done as described in liver examination but in the left hypochondrium region.

***Comment on the following :***

a-Size : distance between the lower pole of the spleen and costal margin in centimeters.
b-Anterior border : rounded
c-Surface : smooth or nodular
d-Consistency : soft , firm or hard
e-Tender or not
f-A notch is palpable or not.
g-Site of upper pole : by percussion in the left mid-axillary line. Normally it is present in the $9^{th}$ intercostal space

## Causes of splenomegaly :

In normal children : 15% of newborn , 15% of children and 10% adolescents
Infectious causes ( typhoid fever , malaria, tuberculosis , infectious mononucleosis, brucellosis , toxoplasmosis , HIV, septicemia ).
Hematological causes : hemolytic anemias, osteopetrosis.
Neoplasms : leukemia , lymphoma , histiocytosis.
Metabolic diseases as Gaucher's disease .
Congestion : in portal hypertension.
Collagen diseases as SLE, systemic form of rheumatoid arthritis.

The most frequent organ to be confused with an enlarged spleen is an enlarged left kidney.

*Differentiation between renal and splenic swelling :*

| | Splenic Swelling | Renal swelling |
|---|---|---|
| 1) direction of enlargement of the organ | Downwards and medially | Downwards |
| 2) Hand insinuation . | The hand cannot be insinuated between the organ and costal margin | The hand can be insinuated |
| 3) Ballottement | -ve | +ve |
| 4) Notch | +ve | +ve |
| 5) Traub's area | Dull | Resonant |
| 6) Renal angle | Resonant | Dull |
| 7) Movement with respiration | Freely movable | Limited movement |
| 8) Percussion | Dull all over and Continuous with splenic dullness | May show a band of resonance due to the colon |

**3- Kidneys :** Kidneys are palpated by the bimanual method. The left hand is placed posteriorly in the loin and the right hand is placed across the lumbar region . When the child takes a breath, immediately after the end of inspiration, the right hand is pressed firmly against the left hand.

**Causes of kidney enlargement include :**

A- Congenital polycystic kidney
B- Hydronephrosis
C- Tumors as Wilm's tumor or leukemic infiltration.
D- Infection : Pyonephrosis.
E- Renal vein thrombosis .

**4- Any other masses :**

The position , shape , size , surface , consistency , tenderness and mobility should be commented upon if a mass is palpated in the abdomen other than enlarged liver , spleen or kidneys.

If an abdominal mass is suspected to be neoplastic → avoid excess unnecessary palpation that may cause dissemination of the malignancy.

Important abdominal masses include

- Neuroblastoma
- Wilm's tumor
- Mesenteric lymphadenopathy.
- Teratoma
- Dermoid cysts
- Ovarian cysts or tumors
- Mesenteric cyst or tumors.
- Retroperitoneal sarcoma.

## III:Percussion :

Findings detected by percussion

1- Borders of organs.
2- To detect presence of ascites.
3- To differentiate between gaseous distension and enlargement of the abdomen due to other causes as organomegaly.

### Methods of examining ascites

### 1- Shifting dullness :

The patient lies supine , the abdomen is percussed starting from the midline towards the flanks . *Organomegaly should be detected properly before performing the shifting dullness. Percussion should be done away from the enlarged organs .*

If dullness is detected in one of the flanks, turn the patient to the opposite side ; allow time for the fluid to gravitate down and percuss again at the point of dullness . If the flank becomes resonant while the patient is lying on his side and becomes dull again when the patient returns on his back → +ve shifting dullness i.e. free fluid in the peritoneal cavity .

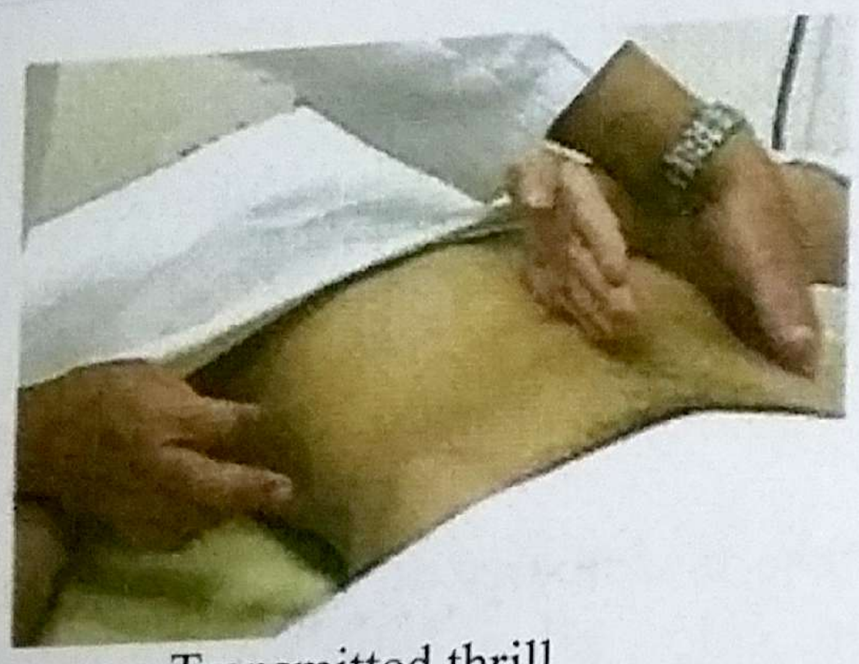
### 2- Modified shifting dullness ( for minimal ascites) :

It can be used if flanks are resonant . Percussion is started as mentioned in ordinary shifting dullness. After percussing one of the flanks and is found to be resonant , the patient is turned to the same side of the percussed flank . Percussion of the flank is repeated in this position ( the patient is lying on the same side of the percussed flank ) , if change in note occurs i.e. becomes dull and returns to resonant when the patient is supine → Presence of small amount of free fluid in peritoneal cavity.

3- Transmitted thrill : for massive ascites :

The patient lies supine , place one hand flat over the lumbar region of one side. An assistant or the patient himself is asked to put the side of his hand firmly in the midline of the abdomen , and then tap the opposite lumbar region. A fluid thrill or wave is felt as a definite impulse by the hand held flat in the lumbar region.

The purpose of the assistant hand is to dampen any impulse that may be transmitted through the fat of the abdominal wall.



Transmitted thrill

## IV :Auscultation :

1-Intestinal peristaltic sounds are normally heard as gurgles every few minutes by the bell of the stethoscope .

-exaggerated : in intestinal obstruction and acute diarrhea

-absent : in paralytic ileus and peritonitis.

2- Hepatic friction or splenic friction rub are uncommon sounds that denote perihepatitis or perisplenitis and splenic infarctions.

3- Venous hum : continuous sound heard in portosystemic anastomosis in portal hypertension. It is usually detected over the epigastrium or the umbilicus.

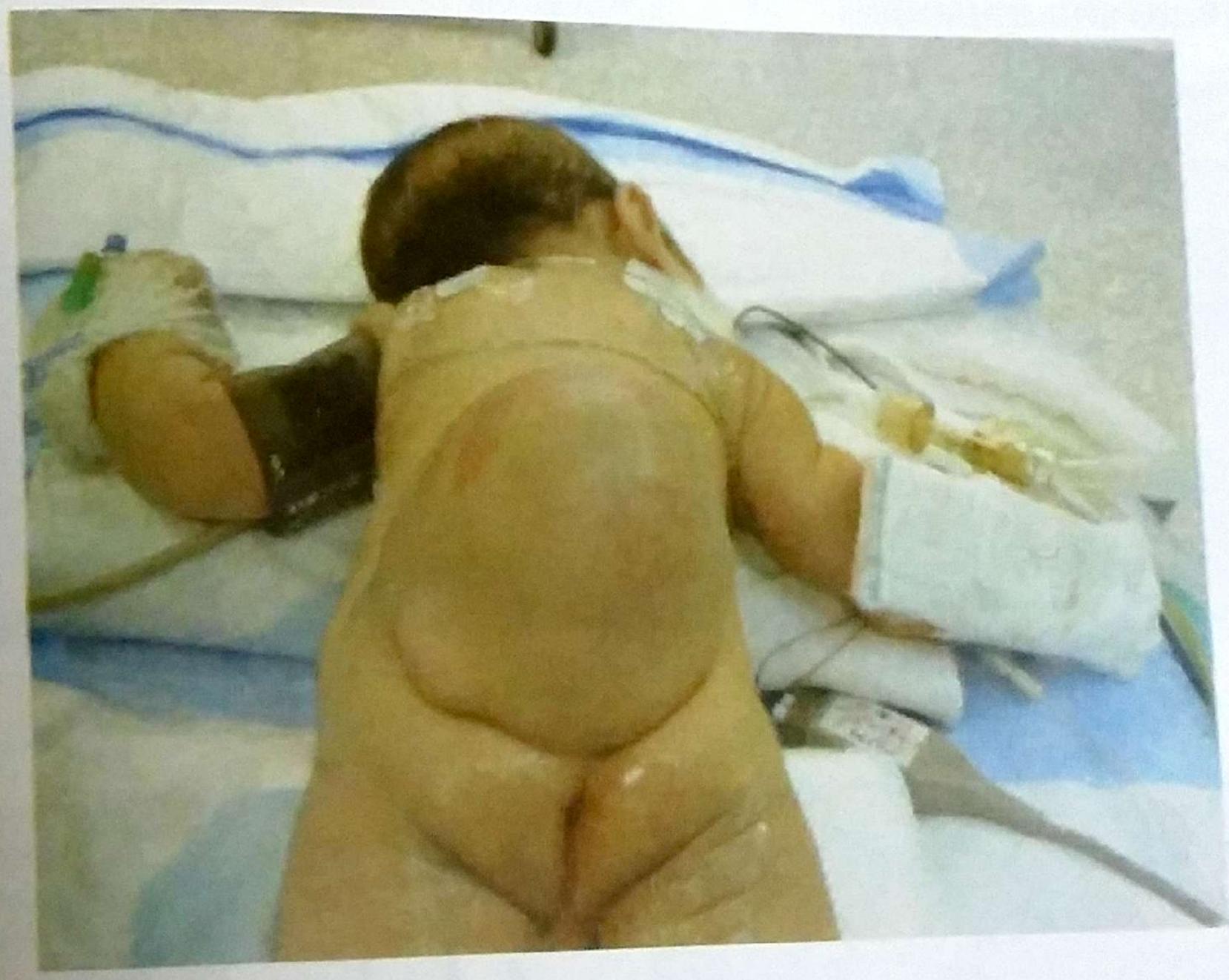
4- Arterial bruit e.g. in renal artery stenosis or vascular tumors of the liver.

## Back and sacrococcygeal region :

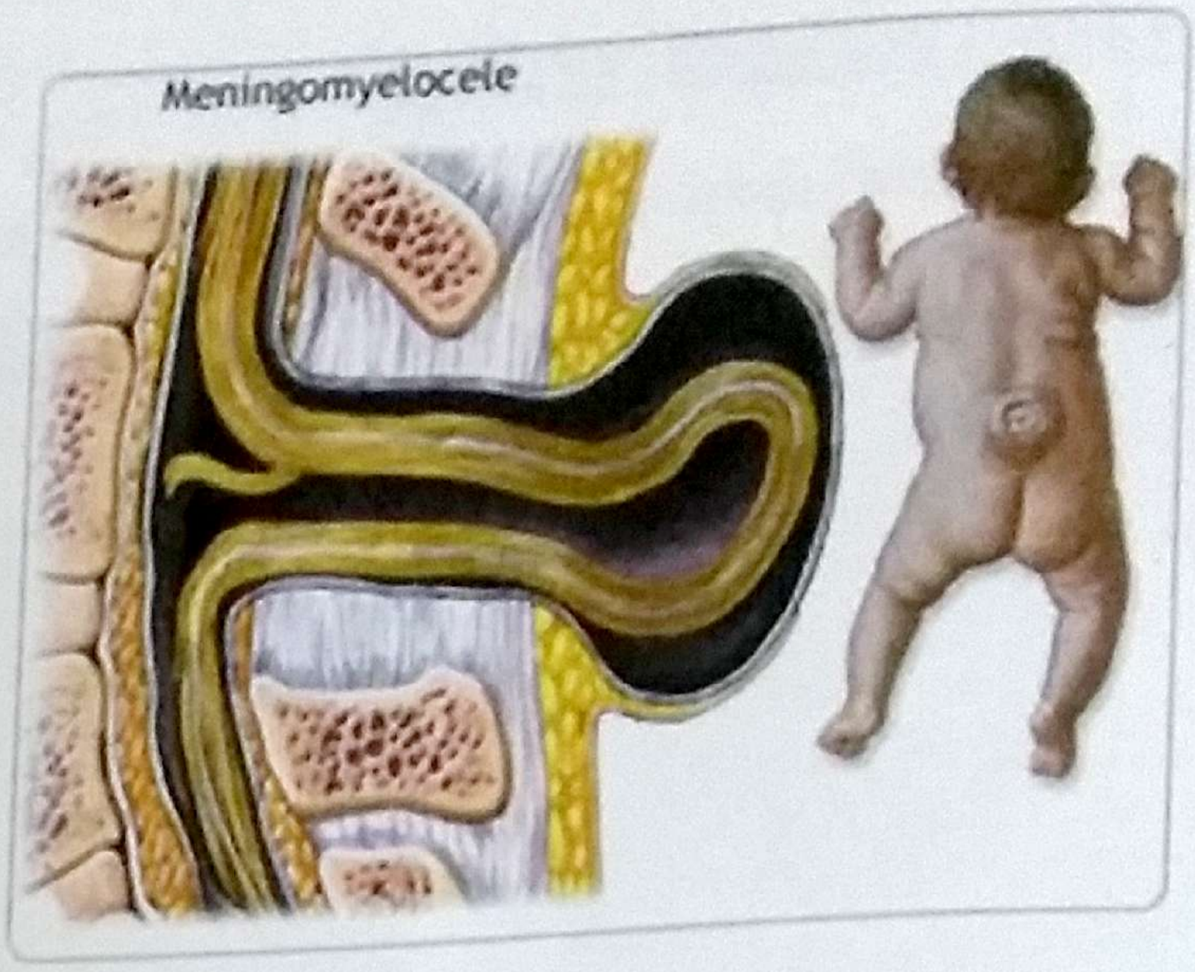
1-Masses as meningocele , meningomyelocele or sacrococcygeal teratoma.

*Meningocele*

*Meningomyelocele*

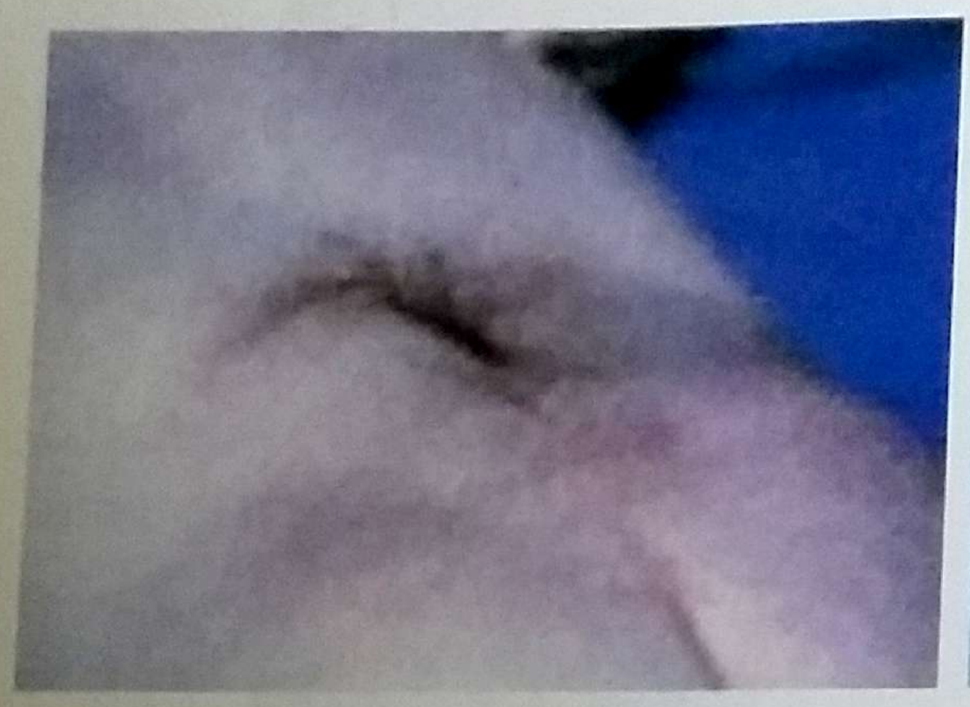


*Huge meningocele*



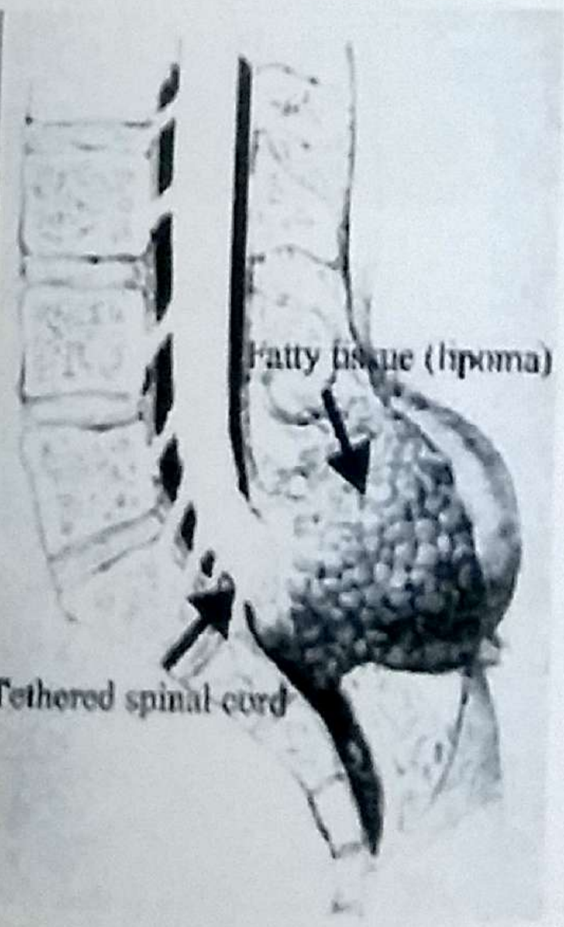

Meningomyelocele : meninges and spinal cord protrude through the defect in the back.

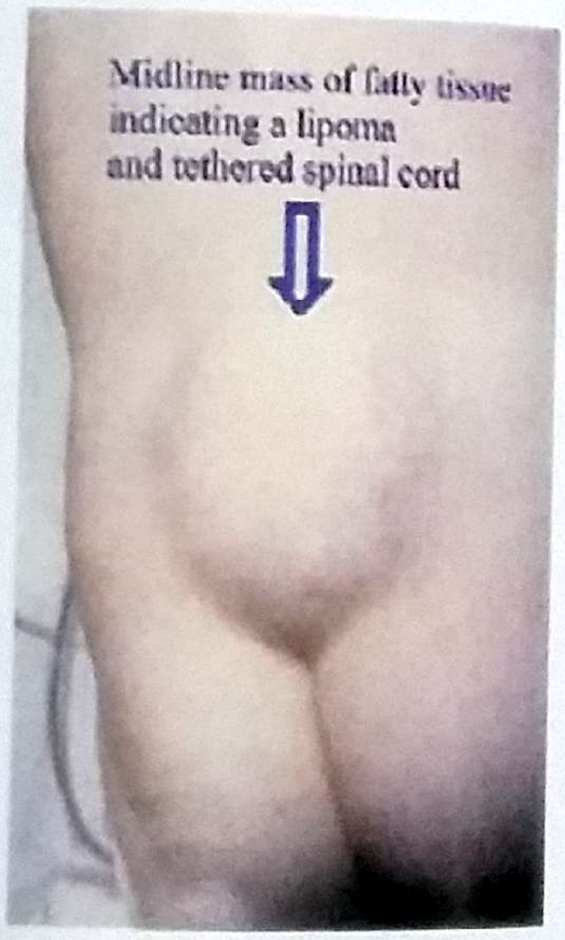
2-Tuft of hair , postanal dimple , nevi , hemangioma or lipoma in sacrococcygeal area may be accompanied by neurological disorders and spinal cord abnormalities.



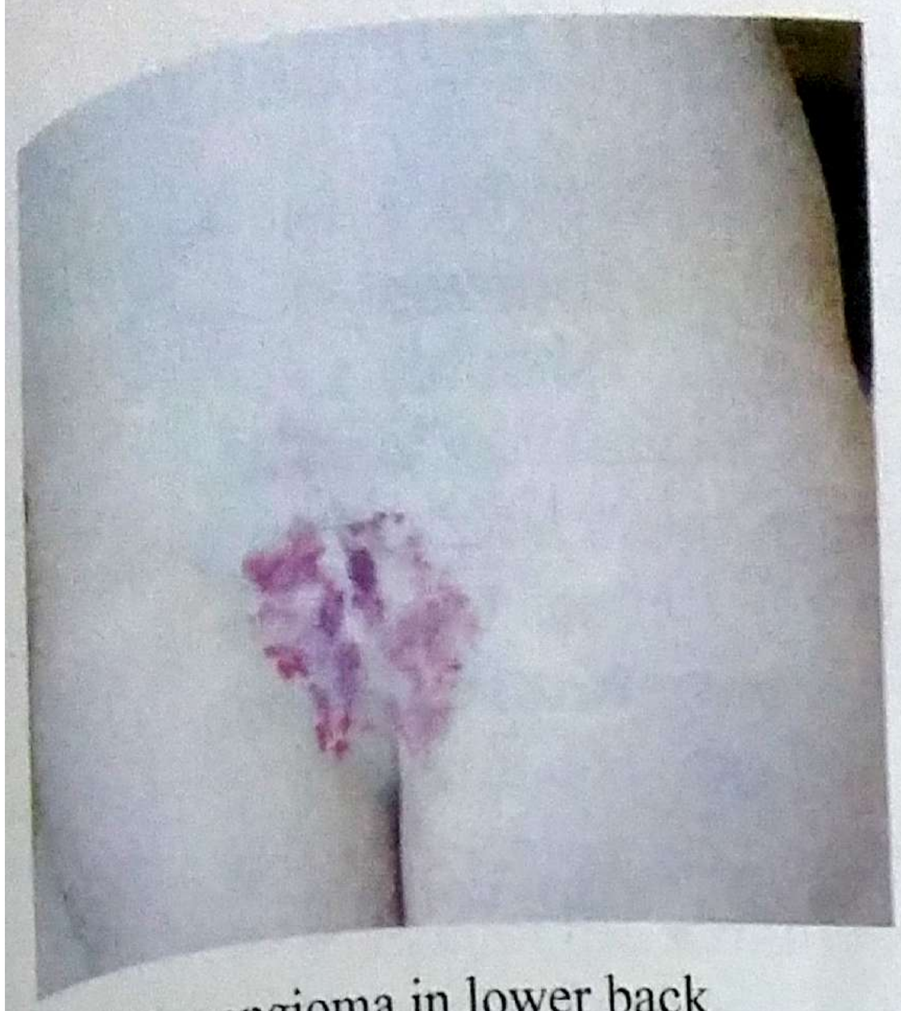
*Tuft of hair*

*Back nevus*




*Lipoma in the back associated with abnormality in the spinal cord*



Hemangioma in lower back

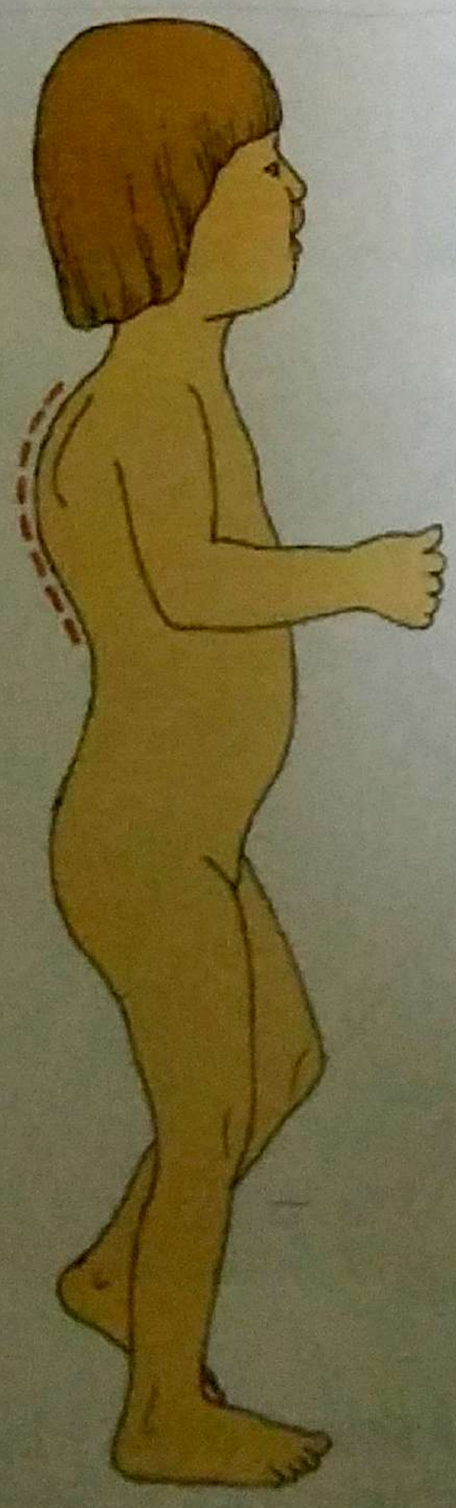
Sacrococcygeal teratoma

## 3-Deformities in the back :

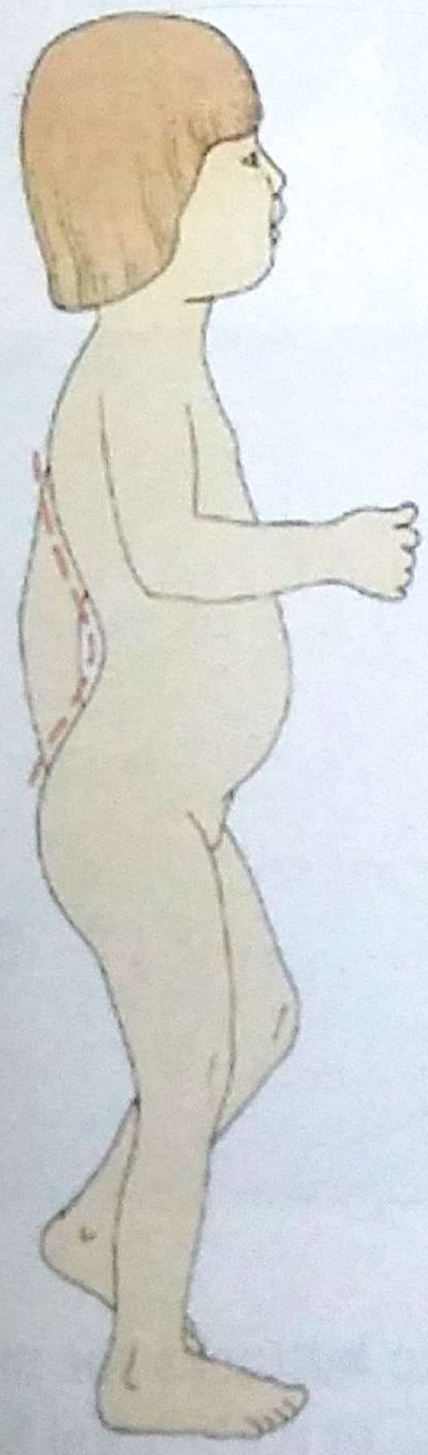
-Kyphosis : in rickets , Pott's disease or mucopolysaccharidosis.

-Scoliosis : idiopathic , or congenital anomalies as hemivertebra, Marfan syndrome or unilateral muscle spasm or weakness.

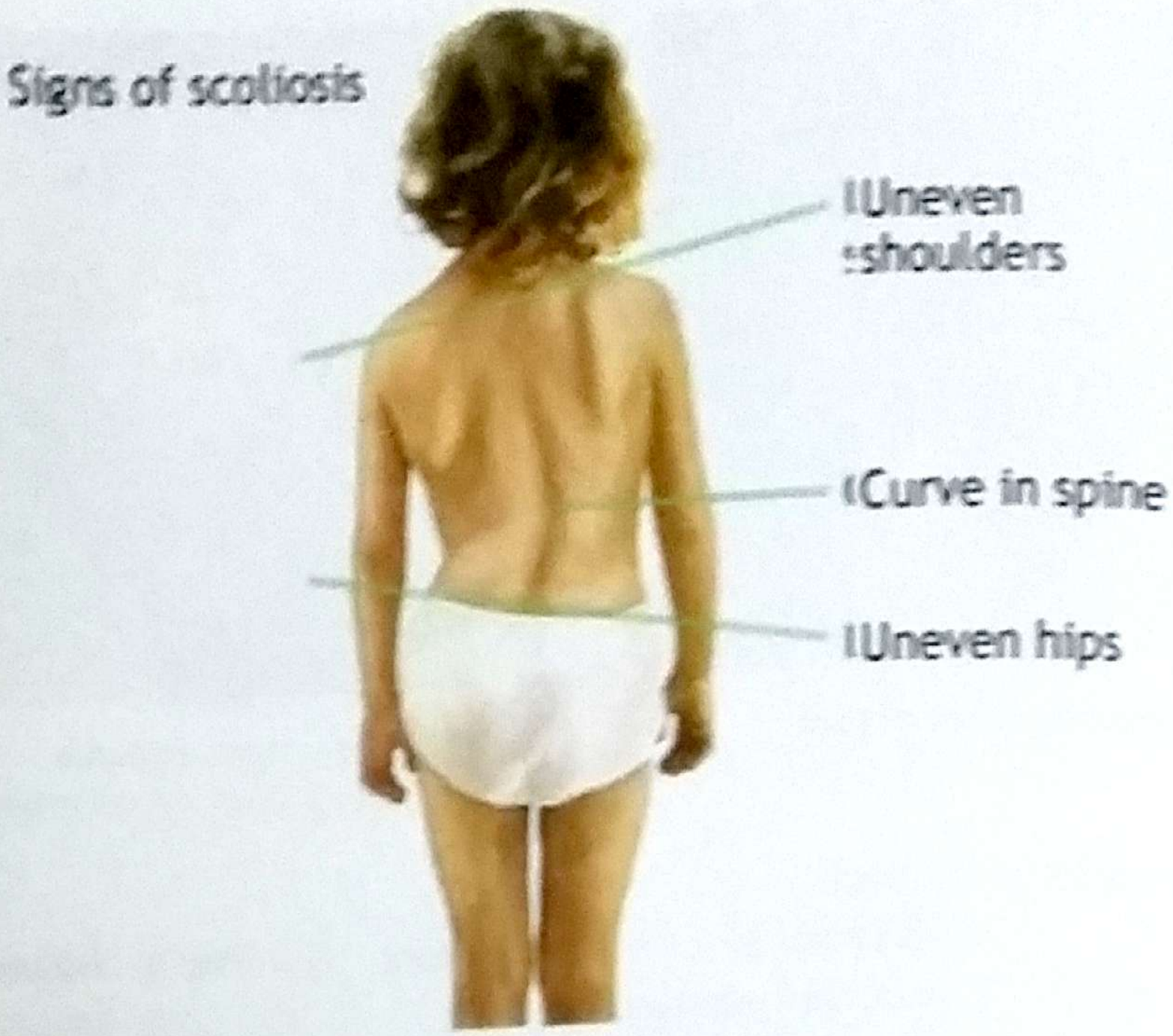
- Lordosis : normal in infants and young children
Congenital dislocation of the hip
Muscle dystrophy



Kyphosis

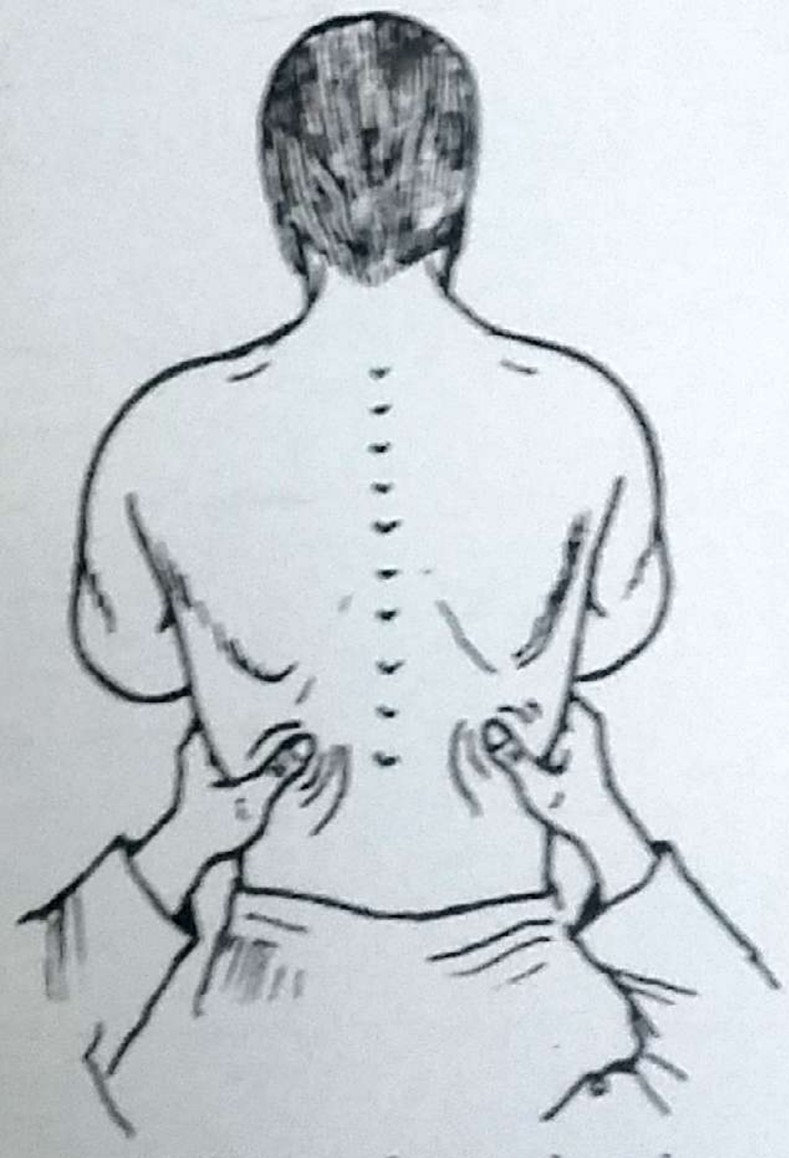


Lordosis




Scoliosis

4- Renal angle : which lies between the last rib and lateral border of paravertebral muscles. It should be inspected , palpated and percussed for evidence of masses or tenderness . Auscultation can detect arterial bruit of renal arterial stenosis.



*Palpating the renal angle*

5- Examine buttocks for masses , or firmness and skin creases which appear asymmetric in congenital hip dislocation .

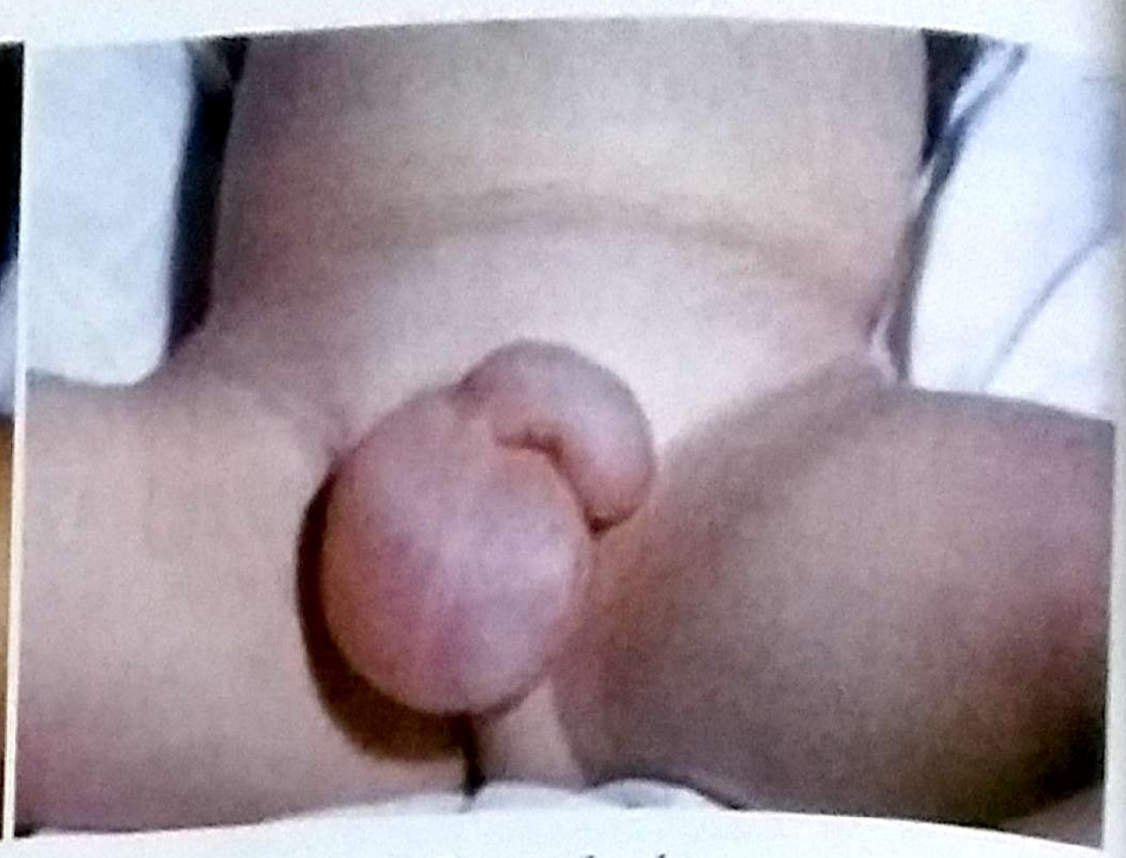
## Examination of the Genitalia :

Inspection of the genitalia is an important aspect of the examination of infants and children . Important items include

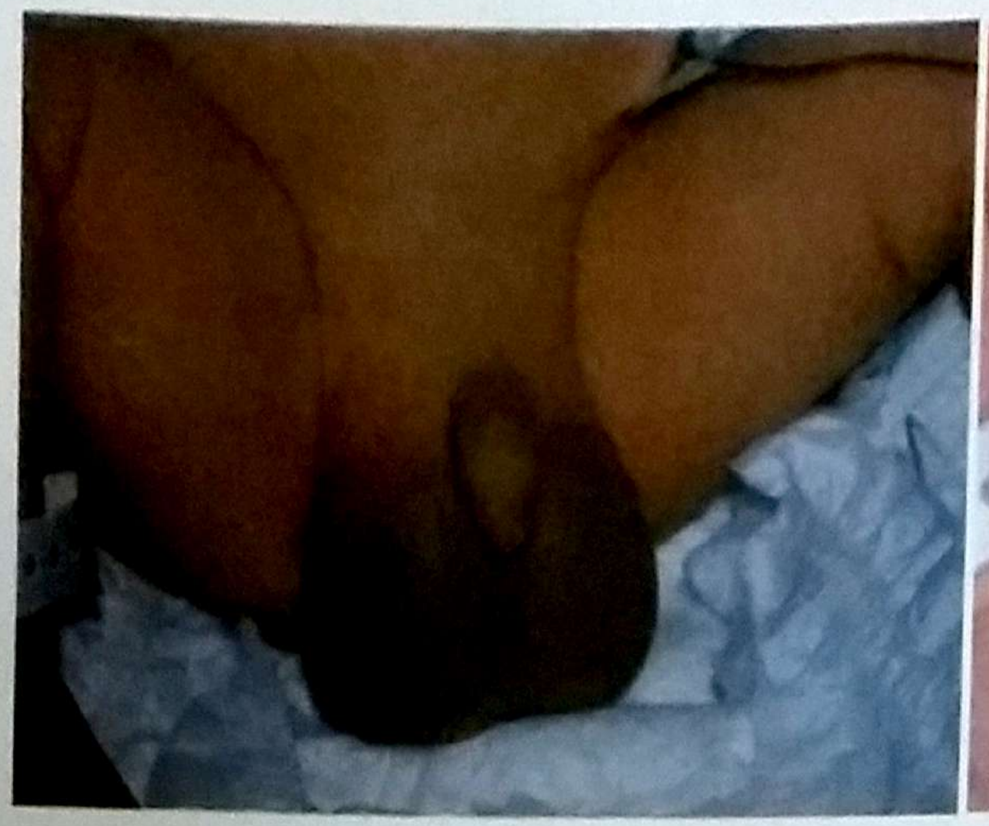
1- Ambiguous genitalia e.g. in congenital adrenal hyperplasia
2- Congenital malformations as epispadius and hypospadius
3- Inguinal hernia
4- Hydrocele in males
5- Undescended testicles
6- In Leukemia , examine for leukemic infiltration of testicles.
7- Edema of the scrotum e.g. in Nephrotic syndrome
8- Puberal changes
9- Urethral discharge or ulceration of urethral meatus.
10-Orchitis.
11-Torsion of the testicles.

*Different forms of Ambiguous genitalia where it is difficult to detect the sex of the infant*

*Rt inguinal hernia*

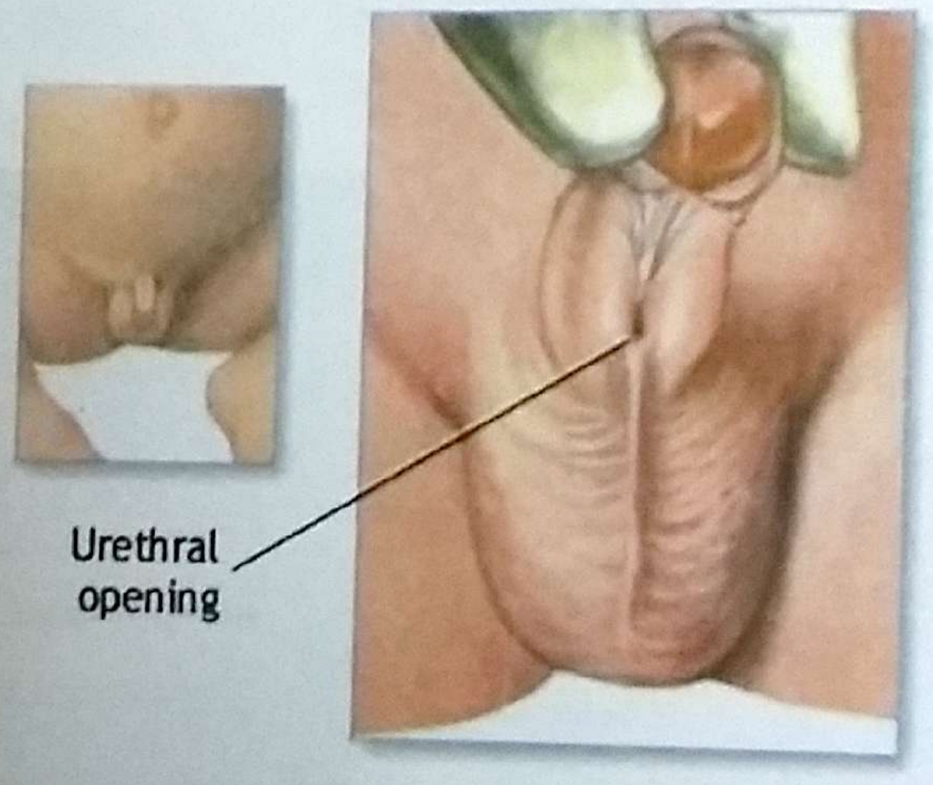


*Scrotal edema*



Hydrocele

Acute torsion of the Rt testicle



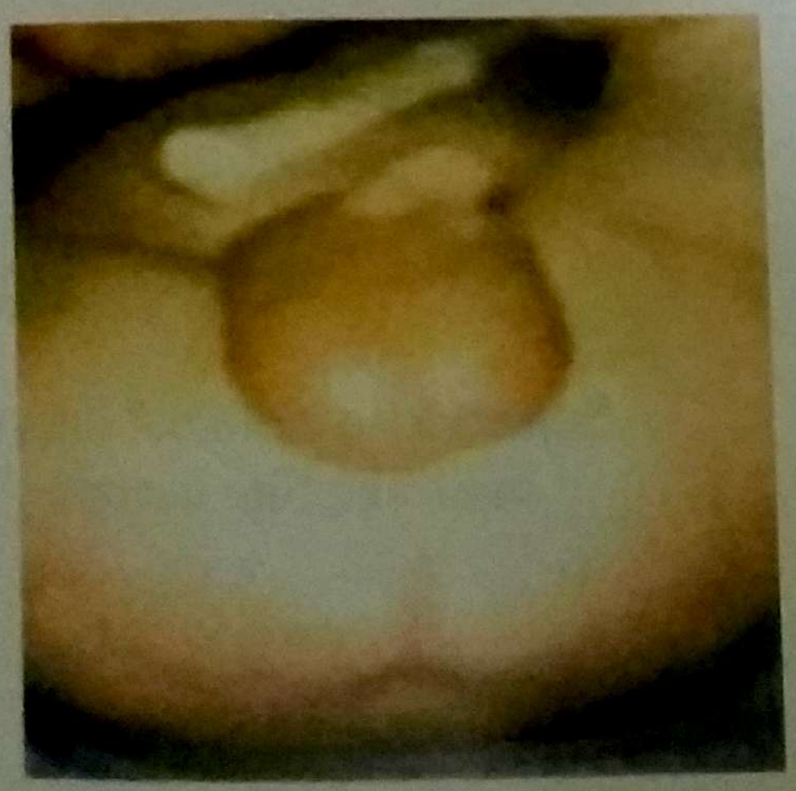

Hypospadius

## Anal region and rectal examination :

Examine the anal region regularly in infants and children . However, rectal examination (PR) is not performed routinely but is reserved for patients with symptoms related to the lower GIT or those with abdominal pain or mass.

Examine the anal region for :

1- Anal atresia, stenosis or ectopic anus ( in neonates).
2- Diaper rash ( Napkin dermatitis).
3- Perianal cellulitis or perianal abscess ( usually streptococcal infection)
4- Anal fissure : appears as a tear in rectal mucosa. The fissure is one of the causes of unexplained cry in infants . It presents by constipation , rectal bleeding and pain during defecation .
5- Rectal prolapse, polyps or hemorrhoids.
6- Pruritus ani may be due to poor perianal hygiene or to Oxyuris infestation .
7- Sensation around the anus and anal reflex ( see nervous system exam.).
8- PR examination ( by lubricated gloved little finger) :
   Note sphincter tone : tight in stenosis , decreased in meningomyelocele and low spinal cord injury.
   Note any masses inside the rectum or in the pelvis.
   In congenital megacolon ( Hirschsprung's disease ) , the sphincter is normal and the rectal ampulla is empty.



Anal Atresia

Rectal Prolapse

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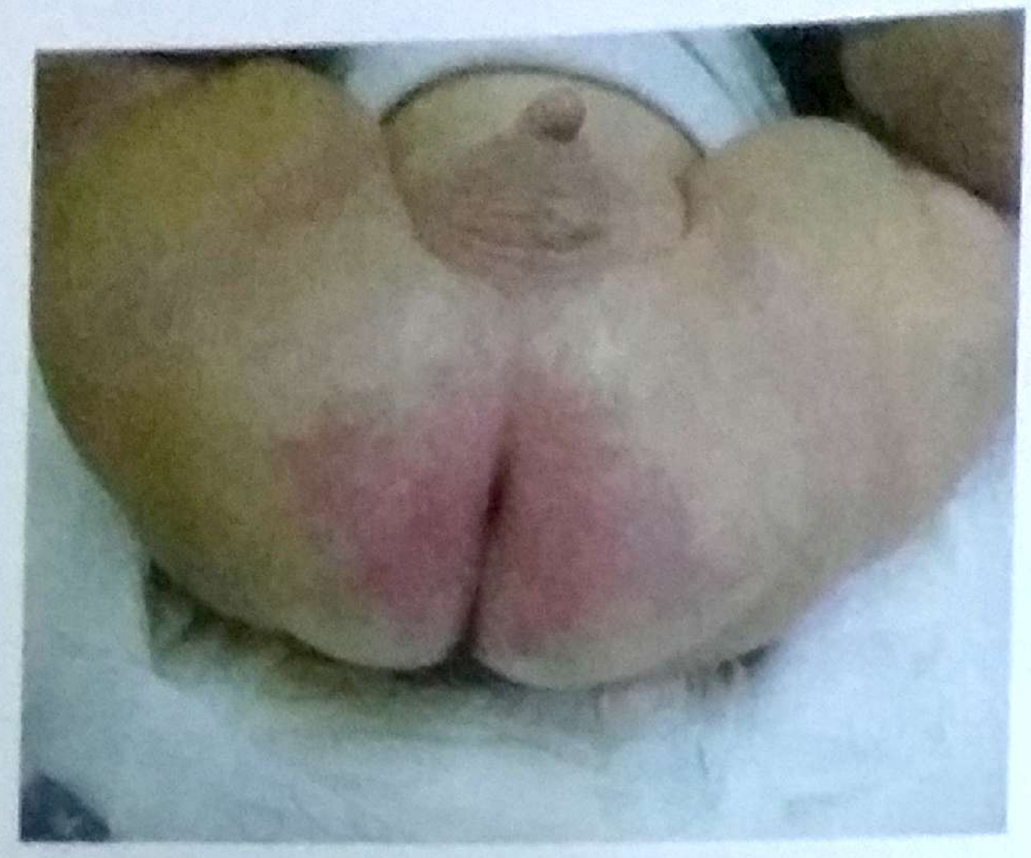
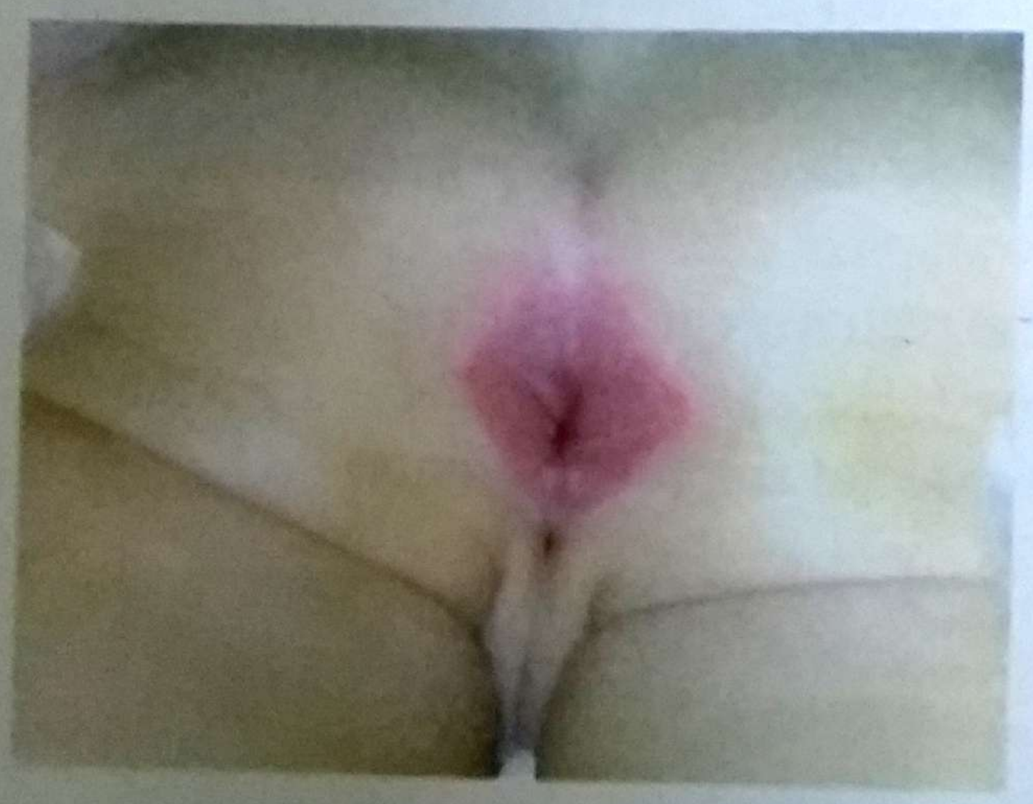
Anal Atresia

Rectal Prolapse



Erythematous form of napkin dermatitis

Ulcerative form



*Perianal cellulitis caused by streptococcal infection*

Superadded candidal infection
note satellite lesions

# The Nervous System

# The Nervous System

Introduction :

The full number of nerve cells is established midway through the prenatal period . Neurons , responsible for memory, consciousness , sensory and motor responses and thought control , increase in size but not number after birth.

Glial cells increase in both size and number until the age of 4 years. Dendrites , responsible for the transmission of impulses across synapses increase in number and branchings. Axons increase in length . The weight of the brain increases from 325 gram at birth to 1000 gram by 1 year of age ( the adult weight = 1400 gram) . Myelinization begins in the 4$^{th}$ month of gestation , progresses throughout early infancy and childhood until the child is able to move voluntarily and to engage in higher cortical functions.

The order in which myelinization occurs corresponds to the normal sequence of development .

## 1 : Cerebral functions :

### 1- State of consciousness :

Consciousness is a process by which a person is aware of self and environment .

Coma is defined as a state of unconsciousness from which the child can not be aroused by ordinary, verbal, sensory or verbal stimuli. There are two routes to coma, one characterized by increased neuronal excitability and the other by decreased neuronal excitability.

In the first one , the patient becomes irritable → confused ( poor orientation) → delirium ( which is defined as agitated confusion , hallucination and autonomic abnormalities as sweating , tachycardia and hypertension ).

Seizures mark the end of delirium and are followed by stupor ( unarousable , but responsive to pain) and lastly coma.

The second route of decreased excitability is characterized by progressive deterioration from lethargy (defined as sleepy state or difficulty in maintaining the aroused state ) to obtundation ( means arousable only by severe stimuli ) then to stupor and lastly coma.

## 2- Intellectual functions ( mentality ):

The reliable diagnostic measure for assessment of intellectual functions in pediatric ages include Bayley Scale of infant development , Stanford –Binet Intelligence Scale or Wechsler Scale. However, these tests are difficult to perform in routine examination .

A simple rough method for assessment of mentality by the non specialist is to observe :

### What does the patient Look , Say and Do ?

*What does he Look ?* means diseases associated with mental handicap and can be diagnosed by looking at the face of the patient :

- -Down syndrome
- -Cretinism.
- - primary microcephaly.
- - Mucopolysaccharidosis.

*What does he say ?* In mental handicap , there is delayed speech development in association with delayed other developmental milestones (usually global delay).

*What does he do ?* for delayed developmental milestones in the fields of gross motor + fine motor + personal social development .

Also , what does he do includes the abnormal behavior e.g. in infancy, the retarded infant may be excessively calm, lying in bed for long periods without crying or interest in the surroundings. In other cases, there is constant or prolonged crying with no cause ( However ,

these findings should be interpreted very carefully ). In older children, rhythmic movements as head banging are common.

3- Handedness :

Handedness usually becomes obvious between the age of 1.5 – 5 years. Obvious hand preferences in a young infant < 18 months of age require a careful search for evidence of hemiplegia.

4- Emotional state :

As emotional instability in rheumatic chorea
Or apathy ,lack of interest in surroundings in kwashiorkor.

5- Memory and orientation to place , persons , time . Observations of the parents and school performance are important guides.

## 2: Cranial Nerves :

I- Olfactory nerve : ( difficult in infants)

Test of smelling : the child closes eyes , the examiner blocks one nostril at a time.
Normal child can identify familiar odors as coffee , or peppermint . Strongly aromatic substances should be avoided as they stimulate irritant receptors in the nose → false response.

II- Optic nerve :

a- Visual acuity :

- counting fingers.
- Snellen eye chart.
- perception of light and color.
- Peripheral vision : bring an object from behind the child into the peripheral field of vision → visual response . The examiner

should be assured that the object rather than a sound produced the visual response.

N.B. the normal newborn can follow light , it is short sighted and reaches normal visual acuity at the age of 6 months.

b- Pupils : are examined for equality , size , and reaction to light. The pupil response to light is affected by drugs , abnormalities of mid brain or optic nerves, metabolic disorders and space occupying lesions.

c- Fundus examination :

to examine optic disk and retina, dilatation of pupils by mydriatics is needed . However , mydriatics should not be used if the patient pupil reaction is necessary to follow the level of consciousness.

In papilledema → blurred disk margins , arteriolar constriction with dilatation of the veins. The capillaries that traverse the optic nerve are difficult to identify.

## III,IV,VI- Oculomotor , Trochlear and Abducens nerves :

A- Eye movements :

- position of the eyes
- abnormal eye movements

Examine eye movements while head is fixed by observing the following of an interested object in all directions

Oculomotor n. paralysis → eyes are displaced outward and downwards with impairment of adduction and elevation.

Trochlear nerve paralysis → eyes are deviated upwards and outwards with head tilt because trochlear n. supplies the superior oblique muscle.

Abducens n. paralysis → medial deviation of the eye with inability to abduct beyond the midline because this nerve supplies the lateral rectus muscle.

- B- Ptosis of upper eyelid : occurs in Oculomotor paralysis ( because it supplies the levator palpebra superiors muscle.

- C- Light reflex and accommodation to near vision : In oculomotor n. paralysis . The pupils are dilated and unreactive to light reflex or accommodation.

N.B. i- External ophthalmoplegia : paralysis of eye muscles and ptosis but preserved pupil responses.

ii- Interral ophthalmoplegia : Dilated pupil not responding to light and accommodation but normal extraocular muscles.

iii- In comatosed or uncooperative children , the eye movement can be examined by Doll's eye maneuver :

- For horizontal movements : turn the head to one side → eyes move to the opposite side .
- For vertical movements : examine in a similar manner by rapid flexion and extension of the head.

## V- Trigeminal nerve :

*Motor function* : by examining masseters , pterygoid and temporalis muscles during mastication ( palpate the temple and jaw as the child bites)

*Sensory function* : The sensory distribution of the face is divided into 3 areas ,the ophthalmic , maxillary and mandibular areas . Each region is tested by light touch and pin prick with comparison of both sides of the face. The eyes should be closed during examination.

- *Reflexes :*

i-corneal reflex : touch the cornea with small piece of cotton → rapid closure of the eye.

ii-jaw jerk : ask the patient to open the mouth . Place your index finger at the tip of the mandible and tap gently with a

percussion hammer. An exaggerated reflex indicates as upper motor neuron lesion above the 5th cranial nerve.

*Jaw jerk*

## VII- Facial nerve :

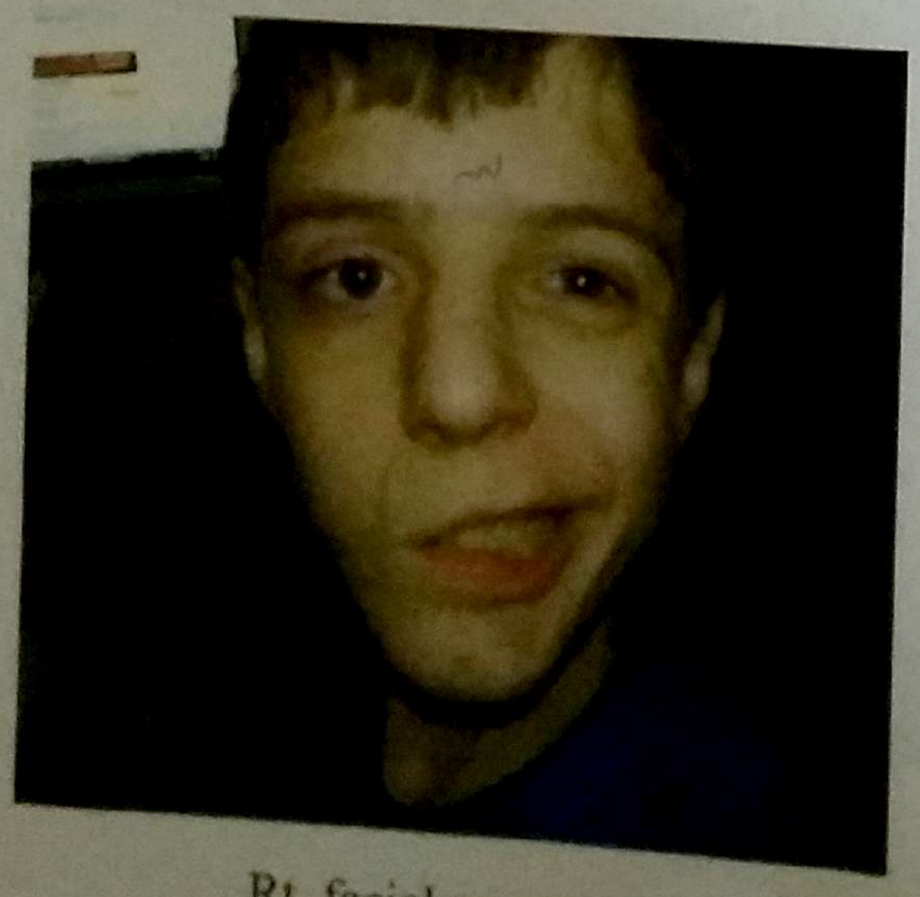
*Motor function :*

- Upper facial muscles : ask the child to
  - a- Elevate eye brows and
  - b- Close eyelids forcibly .
- Lower facial muscles :
  - a- Ask the child to show the teeth
  - b- Observe while smiling and crying → deviation of facial muscles to healthy side .
  - c- Observe absence of nasolabial fold.

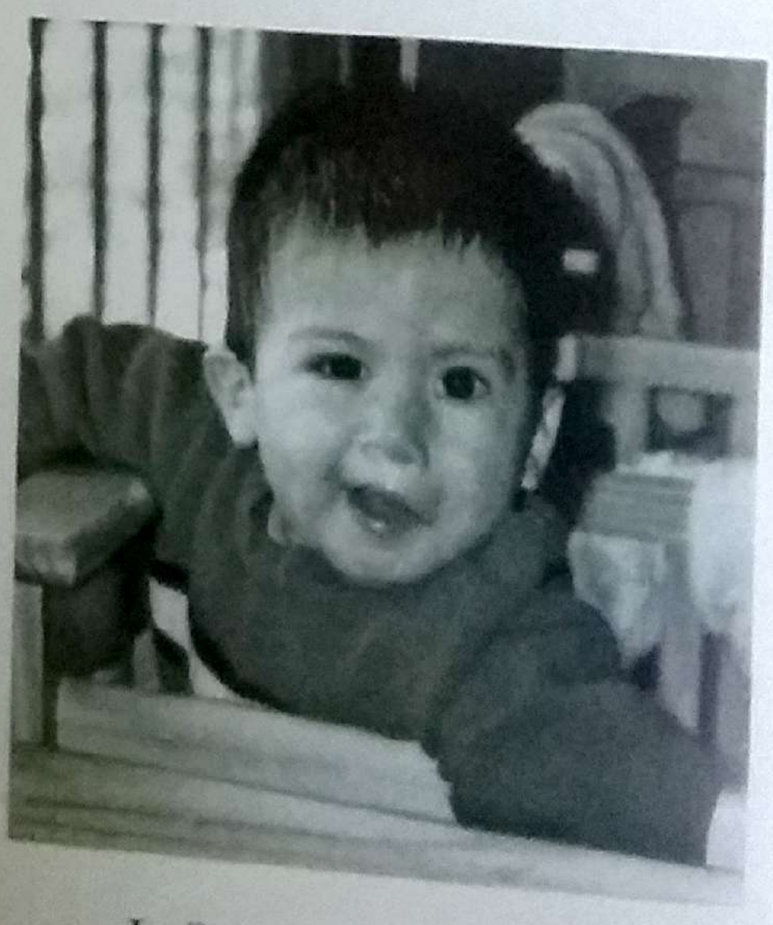
*NB: LMNL of facial n. → upper and lower facial muscles are involved .*
*UMNL of facial n.→ upper muscles only are involved.*

*Sensory function :* in cooperative children

Ability to identify sweet ( sugar) , lemon juice or saline by placing on one side of the tongue



Rt facial nerve palsy



Left facial nerve palsy

## VIII - Auditory nerve :

a- A normal newborn will pause briefly during suckling when a bell is presented, after several stimuli the pause will cease as habituation occurs.

The normal infant will turn its head towards the sound of a bell, rattle and by 3 months will look at the direction of the sound source .
Auditory brain stem evoked potenial is mandatory for any child suspected of hearing loss.

b- Vestibular function : Caloric test : ice water if delivered by syringe into the external auditory canal with patient head elevated 30 degrees → nystagmus with quick component in the opposite direction to the stimulated side.

If no reponse → brain stem dysfunction ( the test is contraindicated ,if tympanic membrane is ruptured) .

## IX-Glossopharyngeal nerve :

pharynged
glosso

*Motor :* observe gag response by touching the posterior pharyngeal wall by tongue depressor .
*Sensory :* ability to identify taste of solutions in the posterior 1/3 of the tongue.

## X- Vagus nerve :

Unilateral paralysis : weakness and asymmetry of ipsilateral soft palate and hoarse voice due to paralysis of vocal cords .

Bilateral paralysis :

- respiratory distress due to paralysis of vocal cords.
- nasal regurgitation of fluids
- difficulty in swallowing .
- immobile soft palate.

### XI- Accessory nerve :

It innervates the serratus anterior muscle , trapezius and sternomastoid muscle .

Trapezius muscle is examined by asking the child to elevate shoulders while downward pressure on shoulders is applied.

Sternomastoid is examined by asking the child to turn the head to one side. Resistance by the examiner could be applied ,

### XII- Hypoglossal nerve :

It innervates muscles of the tongue. Examine the tongue for motility , presence of atrophy or fasciculations. Paralysis of hypoglossal nerve → wasting , weakness and fasciculations of the tongue . The tongue will deviate to the same side of the lesion .

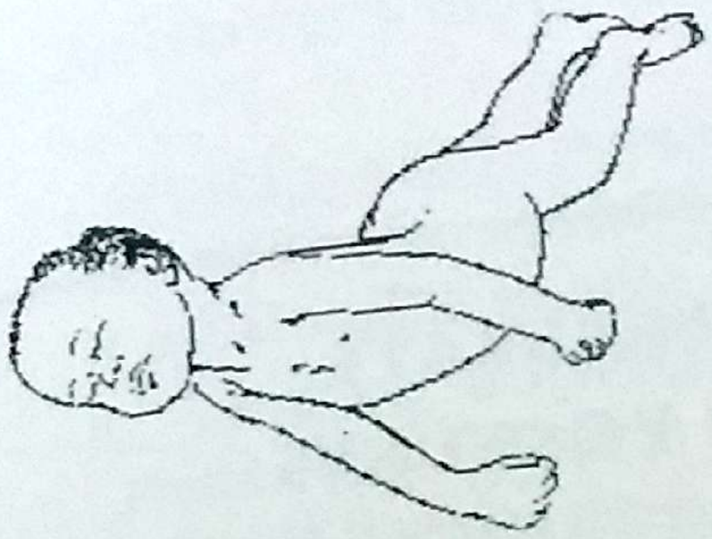
## 3. Motor System :

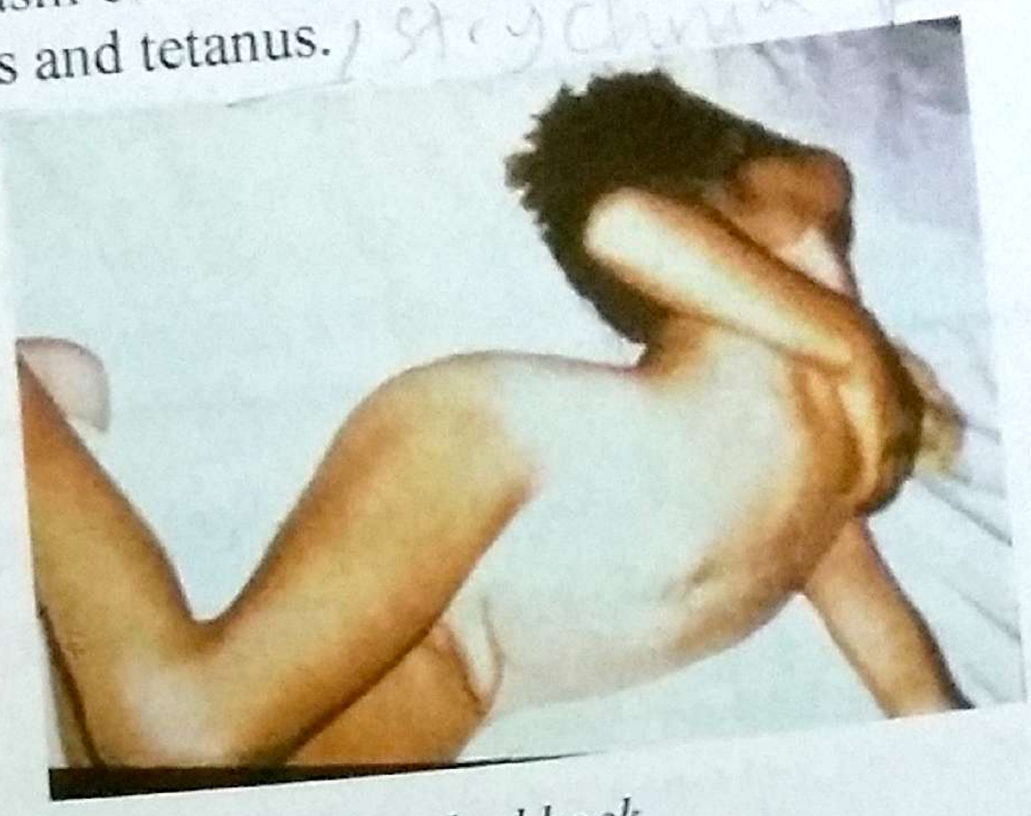
### 1- Posture :

- in spastic quadriplegia type of cerebral palsy : the arms are adducted , elbows and wrists are flexed while the hands are clenched. The legs cross over ( scissoring of the legs) particularly when the child is raised from axilla .

Cerebral Palsy (spastic quadriplegia )

- Opisthotonus is an involuntary extension of the neck accompanied by arching of the back due to spasm of nuchal and back muscles. It is seen in cerebral palsy , meningitis and tetanus.





*Opisthotonus : extension of neck and arched back*

- Frog like position : the child lies with hips abducted and knees flexed . This is a sign of hypotonia rather than weakness in legs.

*Frog like posture*

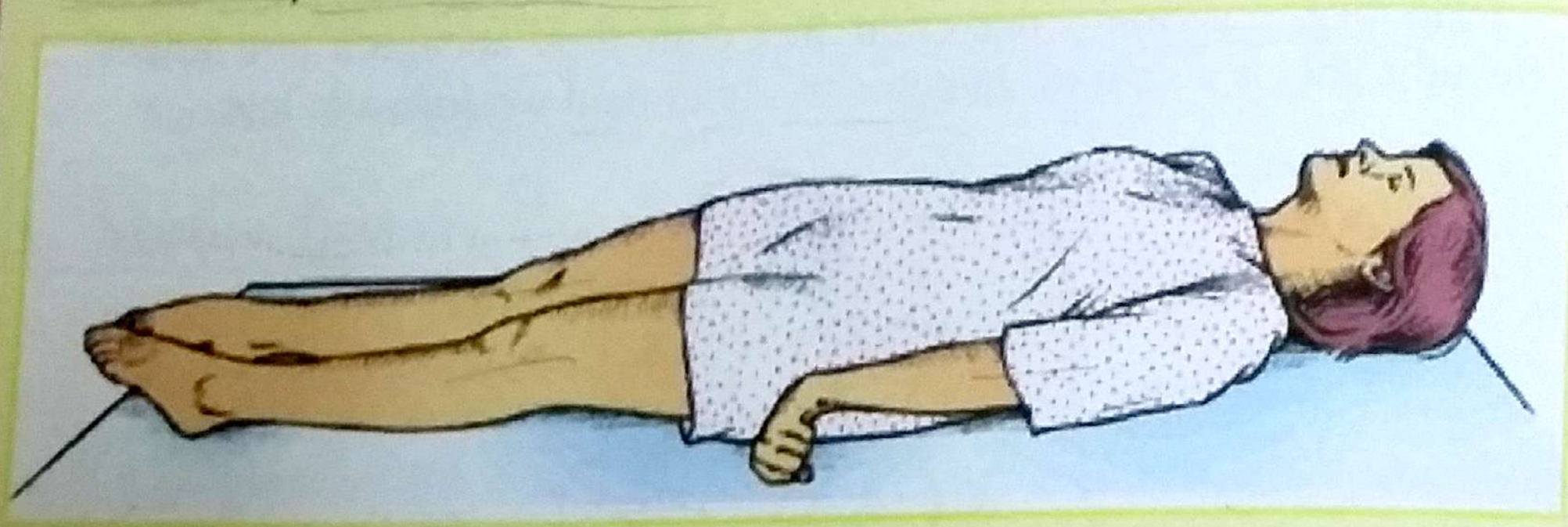
- In Erb's paralysis , the arms are adducted, internally rotated , elbows are extended with flexed wrist.

*Erb's paralysis of right upper limb*

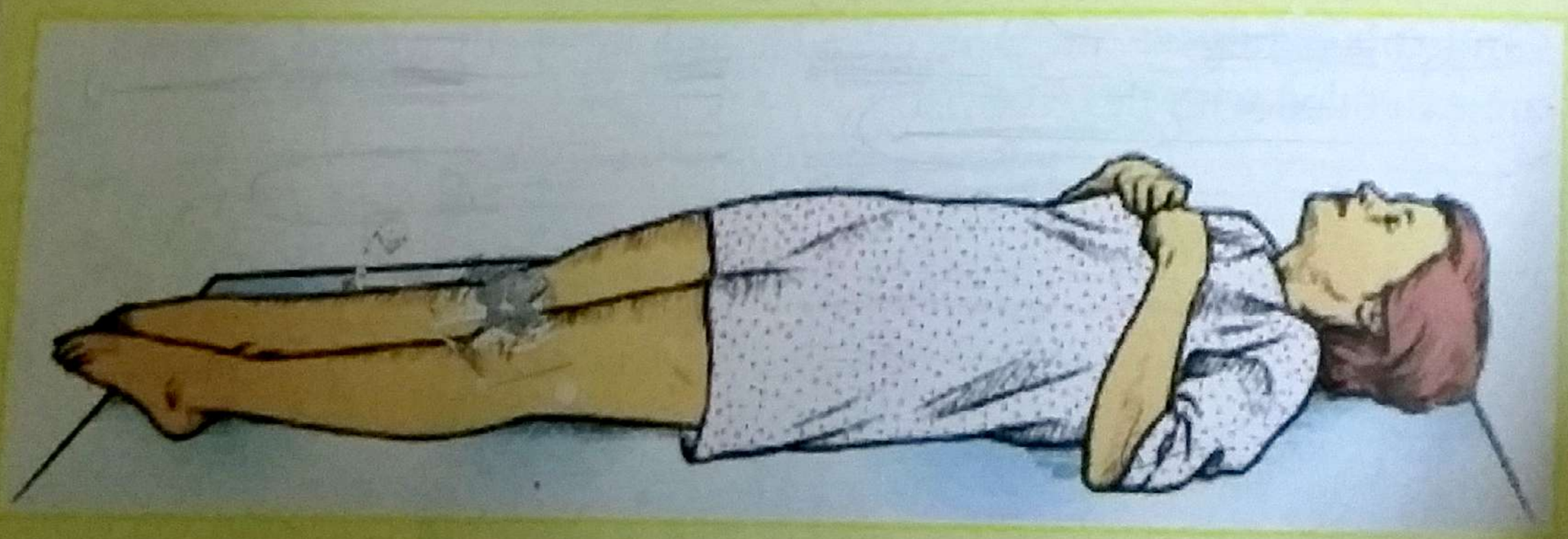
- Decerbrate and Decorticate postures seen in brain damage : Decerbrate posture is seen in damage of the upper brain stem while Decorticate posture is seen in damage of corticospinal tracts.

## COMPARING DECEREBRATE AND DECORTICATE POSTURES

Decerebrate posture results from damage to the upper brain stem. In this posture, the arms are adducted and extended, with the wrists pronated and the fingers flexed. The legs are stiffly extended, with plantar flexion of the feet.



Decorticate posture results from damage to one or both corticospinal tracts. In this posture, the arms are adducted and flexed, with the wrists and fingers flexed on the chest. The legs are stiffly extended and internally rotated, with plantar flexion of the feet.



## 2- muscle bulk : Loss of bulk may be due to LMNL , muscle disease or generalized wasting .

## 3- Involuntary movements :

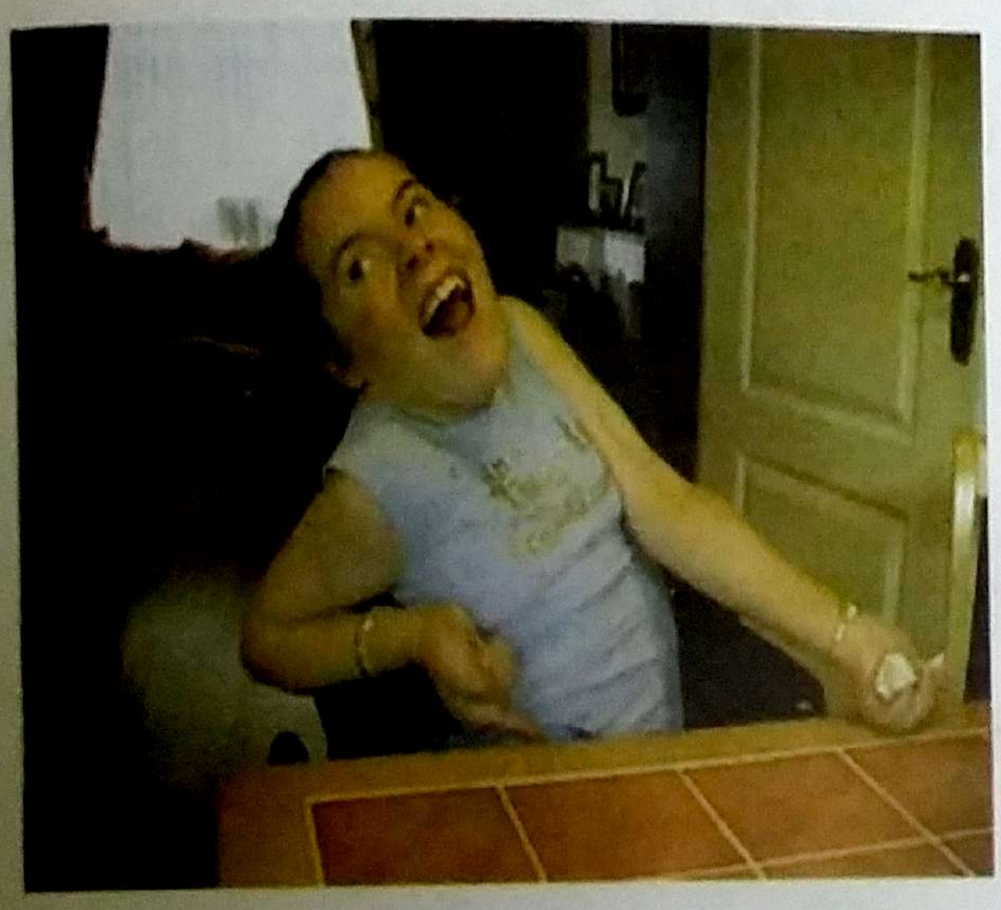
*a- Fasciculations :* muscle twitch due to sponateous contraction of muscles seen in LMNL e.g. fasciculations of the tongue seen in spinal muscle atrophy.

*b- Tremors :* involuntary , rhythmic alternating movements. Tremors may occur at rest or only during movement as in cerebellar diseases ( intention tremors). Tremors of the head and neck is called titubation.

*c- Chorea :* rapid , jerky, irregular purposeless movements that increase with excitement . Causes include rheumatic chorea, Huntington's chorea, Wilson's disease .

*d- Athetosis :* slow writhing movements most evident in extremeties.

*e- Dystonia :* involuntary sustained contraction of muscle groups leading to prolonged ,often twisted posturing of the face , limbs or trunk .



Dystonia in trunk and limbs

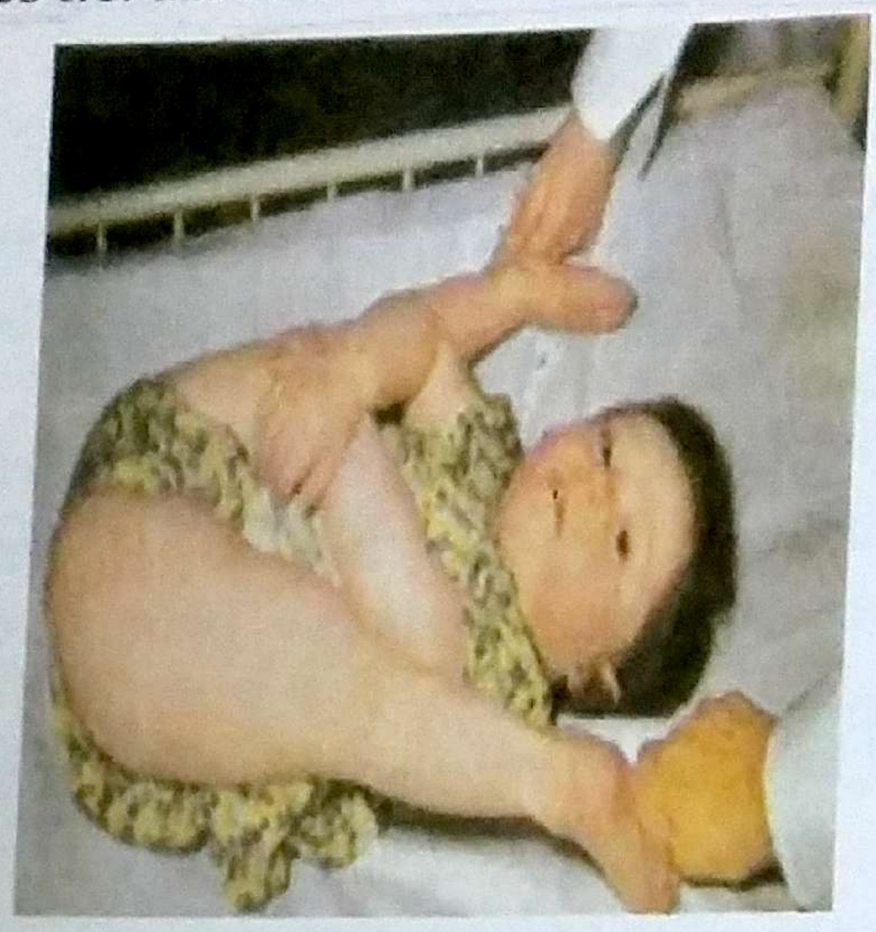
Dystonia of the hands

## 4- Tone : resistance against passive stretching of muscles :

How to examine :

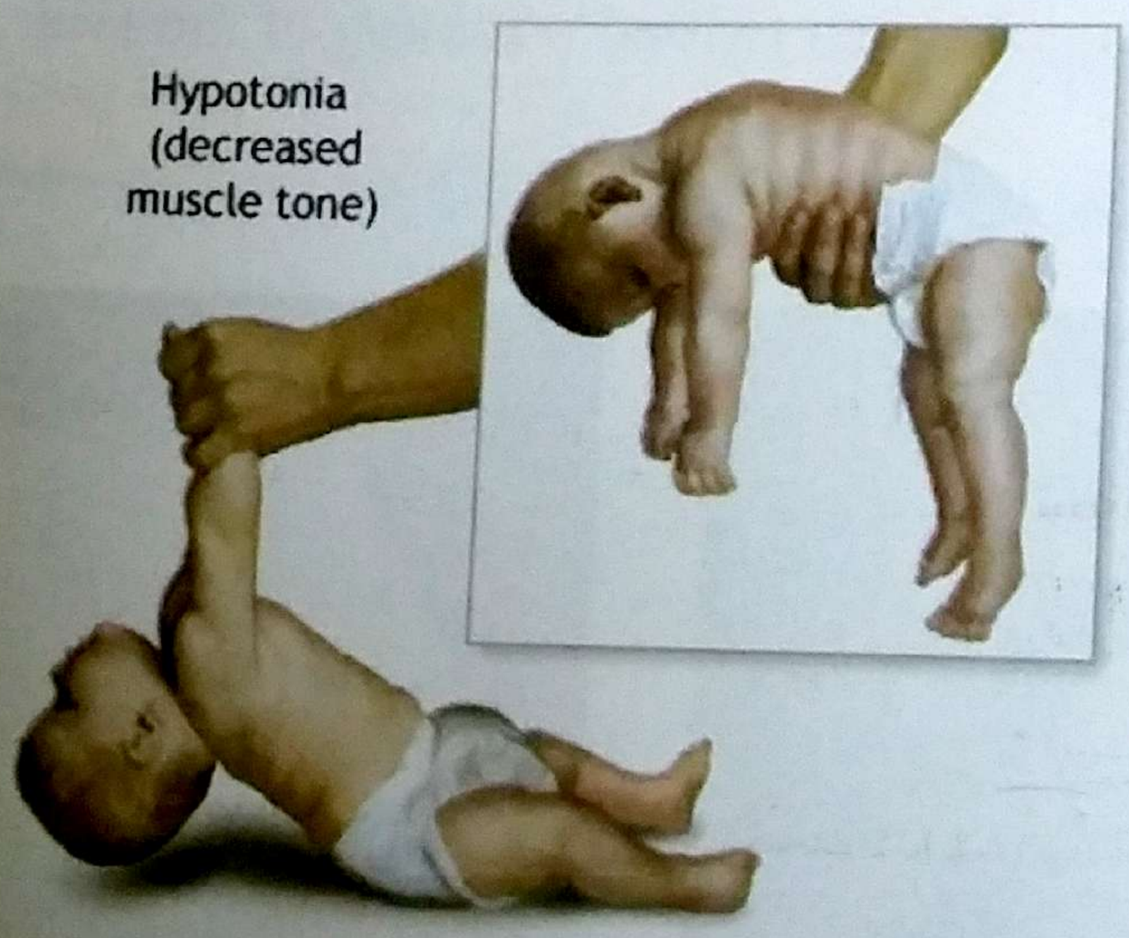
- Passively flex and extend the extremeties. Assess the resistance to the passive movements.

- Examine for range of movement ( acrobatic movements ) as heel to ear test. In generalized hypotonia , the range increases i.e. acrobatic movements are easy .



*Acrobatic movement in generalized hypotonia*

- Pull to sit test : In hypotonia → Head lag ( see picture).
- Ventral suspension → The body takes inverted U shape.




Pull to sit and ventral suspension

## 5- Power :

A) In infants :

**i-Lower Limbs :** by using light pin prick to apply a slightly painful stimulus. The movements in ankles, knees and hips are studied on both sides

*Ankle joint* : 4 movements ( dorsiflexion, plantar flexion,evertion and inversion) . Observe at first , the infant may move the feet spontaneously. Otherwise, restrict the movement of the knees , then apply the pin prick in a manner to stimulate the required movement e.g. to study dorsiflexion → the painful stimulus is applied to the sole.

*Knee joints* : 2 movements : flexion and extension . If we apply painful stimulus to the sole without restricting the knees , the infant should withdraw the leg by flexion of the knee and hip.

To examine the extensors of the knee , apply painful stimulus to the calf while the knee is flexed → the infant should extend the knee joint.

*Hip joints* : 4 movements ( flexion, extension, abduction and adduction) . The infant lies on his side and apply painful stimulus to the thigh to examine different movements .

**ii-Upper limbs :**

- Let the infant hold an object
- Pull the infant by the arms from a supine position , an infant with normal power will flex at the elbows to resist your pull.
- As in lower limbs, use pin prick to examine the movements in joints.

**iii-Abdominal muscles :**

- Inspect for bulging of abdominal muscles during crying.

**iv-Respiratory muscles :** weakness or paralysis is detected by

- weak cry or weak cough
- Respiratory difficulty.
- In diaphragmatic paralysis : there is paradoxical movement of the anterior abdominal wall during respiration i.e. in inspiration, it moves in while in expiration it moves out ( opposite to movement of chest wall ). In inspiration the negative intrapleural pressure makes the paralysed diaphragm moves

upwards (normal diaphragm moves downwards) → the abdominal muscles moves in opposite direction to the normal .

**v-Neck muscles :**

Test if the infant can support the neck during sitting and when pushing the infant gently sideways.

B) In older children :

**i-Upper limbs** : order the child to

-Abduct and adduct the arms (without and then with resistance).
-Flex and extend the elbows (without and then with resistance ).
-Flex and extend the wrists (without and then with resistance ).

**ii-Lower limbs :** order the child to

-Elevate one leg and keep it in air while the examiner is pushing it down.
-Keep the leg in bed while the examiner is trying to elevate it.
-Flex the extended knee against ( without /with resistance ).
-Bend the knee at right angle then try to extend the knee ( without/with resistance )
-Dorsiflex and plantar flex the foot ( without/with resistance).

**iii-Limb girdles and trunk :**

- *The shoulder girdle :* ask the child to comb his hair . He may be able to do so initially but becomes tired quickly.
- *The trunk* : can he sit from a supine position without the aid of his arms.
- *The pelvic girdle :* ability to stand from a squatting position .

**Gower's sign :** it is described in children with Duchenne muscle dystrophy. It describes how can the child with this disease gets up off the floor. The child will roll onto his front and then climbing up his legs then pushes against his thighs to straighten up.

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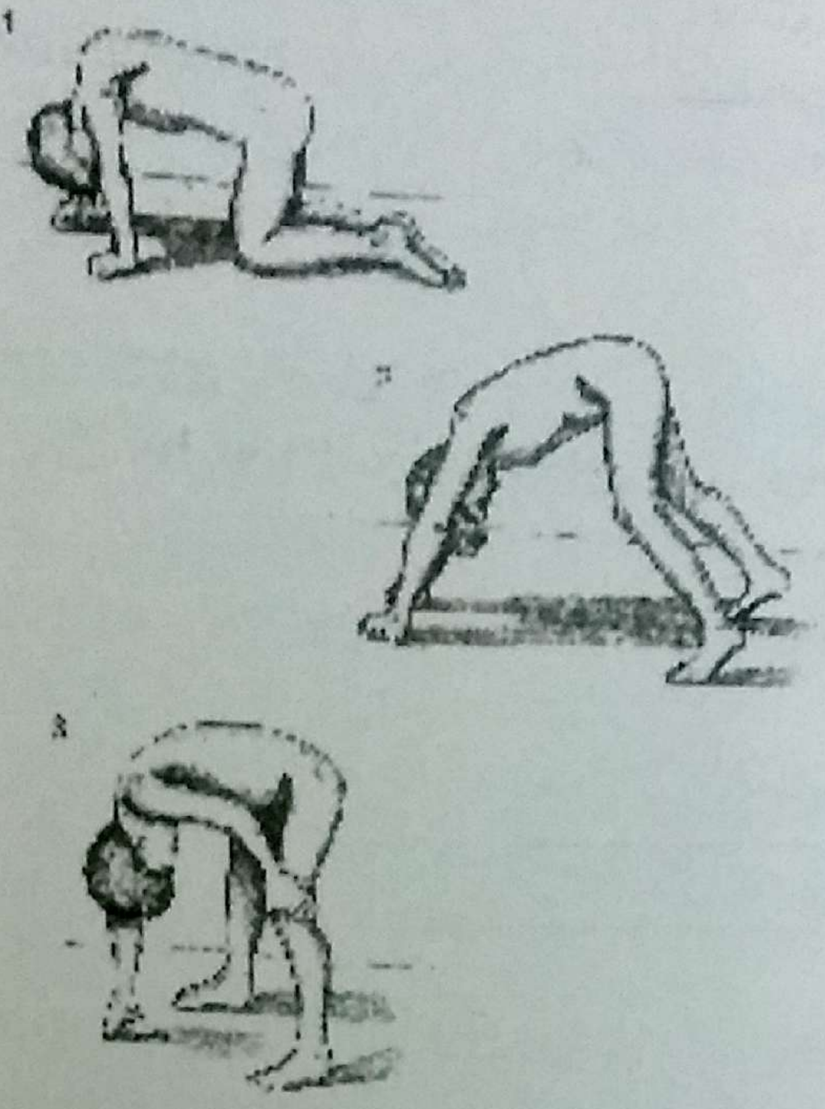


Gower sign

Power of muscles can be graded as follows :

Grade 0 : No contraction.
Grade 1 : flicker of contraction
Grade 2 : active movement , with gravity eliminated.
Grade 3 : active movement , against gravity.
Grade 4 : movement against resistance by the examiner.
Grade 5 : Normal power .

6: Coordination : This is a complex function requiring normal motor, sensory and cerebellar system

**Tests of coordination** include :

*A- In infants :* Observe the infant's play . Offer the infant an interesting toy and observe :

- Does he reach it ?
- is there any intention tremors?
- can he grasp the toy normally?
- does he transfer between hands ?

*B- In children :*

i- Finger to nose test : ask the child to touch his nose then your finger repeatedly. Look for intention tremors or post pointing (overshoots or misses the object you offer to him ).

ii- Dysdiadochokinesia : rapidly and repeatedly tap one hand with the other ( each tap is done by the palm then the dorsum of the tapping hand ) . Difficulty at such test occurs in cerebellar disease , or abnormalities of tone or power.

iii. Writing and drawing .
iv. Buttoning and unbuttoning.

v. Tandem gait : make the child walk along a straight line with the heel of one foot touching the toes of the other.
vi. Heel – knee test : The child lifts one leg in the air , place the heel of this leg on the opposite knee and then slide the heel down the shin towards the ankle. The test is impossible if incoordination is present.

## 7: Gait :

a- In spastic diplegia : stiffness of legs and toe walking. If the infant is crawling on his knees , the feet are held off the floor.

b- Wide based : normal in toddlers. Cerebellar ataxia causes wide based gait

c- Waddling gait : in untreated congenital hip dislocation or in Duchenne muscle dystrophy. The body sways from side to side.

d- Hemiplegic gait : The affected leg is held straight and move stiffly. The hip is adducted and extended , knee is extended and ankle is plantar flexed . Forward movement is achieved by circumduction , the foot is scraping the floor . There is limited swinging of the arm and elbow flexion on the same side .

Toe walking

## 4:Sensory system :

### A-Superficial sensations

*1-Touch :* touch the skin lightly by a piece of cotton and ask the patient if he felt any thing . (eye closed)

*2- Pain:* by demonstrating withdrawal from painful stimulus using a pinprick ( the tip of the pin should be reasonably blunt).

*3-Temperature:* not routinely used especially in young infants.
Two test tubes ( one containing warm and the other cold water.)
Ask the child to comment on the sensation perceived

### B-Deep sensations :

- Sense of pressure.
- Sense of movement ( or position).
- Vibration sense.

1- Sense of pressure : Press the calf muscle , the child feels pain.

2- Sense of movement ( or position):

*Upper limb :*

- Hold the middle phalanx of the child index finger Then , flex and extend the distal phalanx .
- Now ask him to close eyes and say up and down when you move his finger.

*Lower limb :* by the same technique as upper limb , but examine the movement of big toe.

3- Vibration sense : Place the base of a vibrating tuning fork on a bony prominence ( e.g. the patella ) while the child is closing eyes . Ask him to comment on the feeling . He will generally describe it as a buzzling feeling . Perception of the cessation of vibration is more sensitive than perception of the presence . Ask the child when the buzzling stops. Testing of vibration sense has significance in posterior column lesion as in Friedreich ataxia.

Deep sensory loss in a child occurs in peripheral neuropathy as in :

- Vincristine neuropathy in treatment of leukemia.
- Guillain - Barre´ syndrome
- Friedreich ataxia.

***Romberg's sign :*** This sign provides evidence that ataxia is due to deep sensory ( proprioceptive ) loss. The child stands with his feet together. Observe him for a few seconds and then ask him to close his eyes . The sign is considered positive if he becomes significantly unsteady after closure of the eyes..

## C-Cortical Sensation :

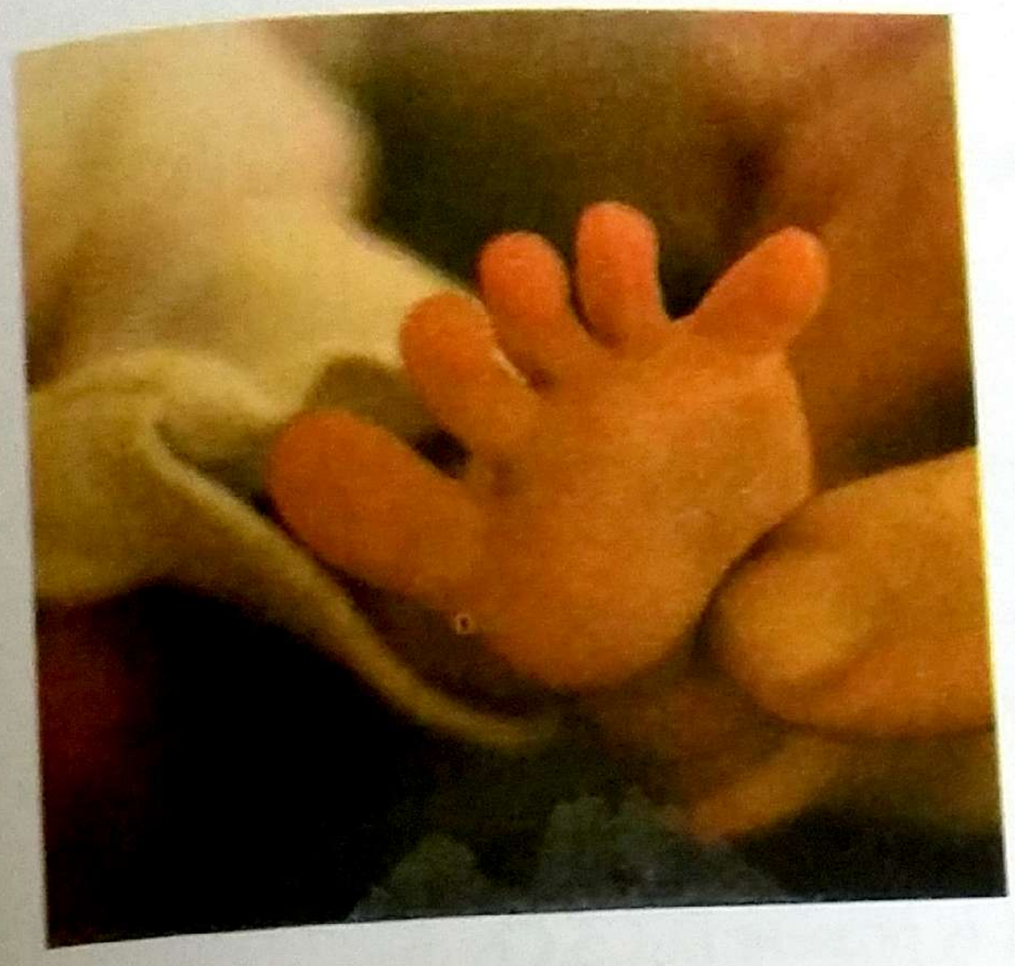
*e.g. Stereognosis* : in the old child , have the eyes closed and place in his palm familiar objects as coins or a pencil. Ask him to identify the objects and to describe their form. Loss of this sensations occur in parietal lesions.

## 5: Reflexes :

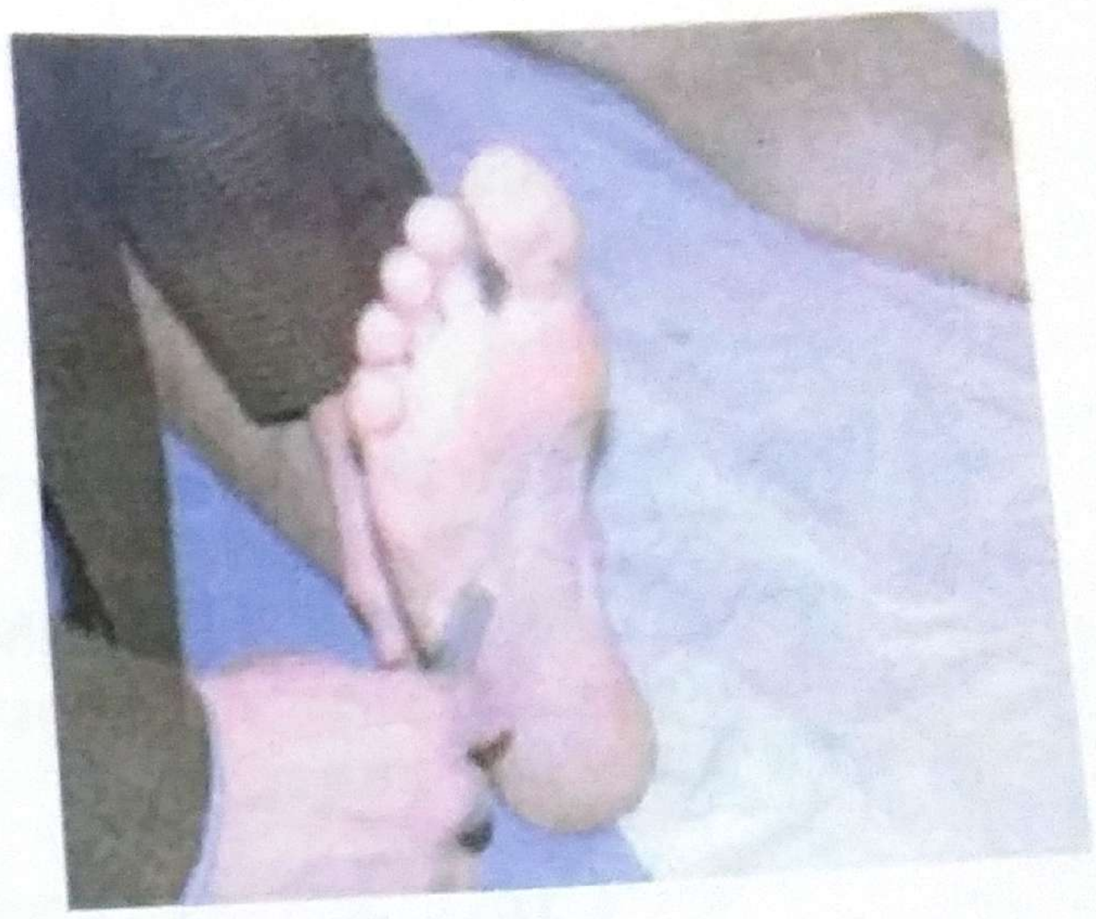
### 1) Superficial reflexes :

a-Plantar reflex : Stroke the sole of foot along outer edge beginning from heel → the normal response which usually starts after 1st year of life is to plantar flex the foot . In abnormal response, dorsiflexion of the foot with fanning of the toes ( i.e. extensor plantar response or Babinski sign).

The centre of the reflex is present in L4, L4 S1 and S2



*Plantar reflex is extensor in the newborn*

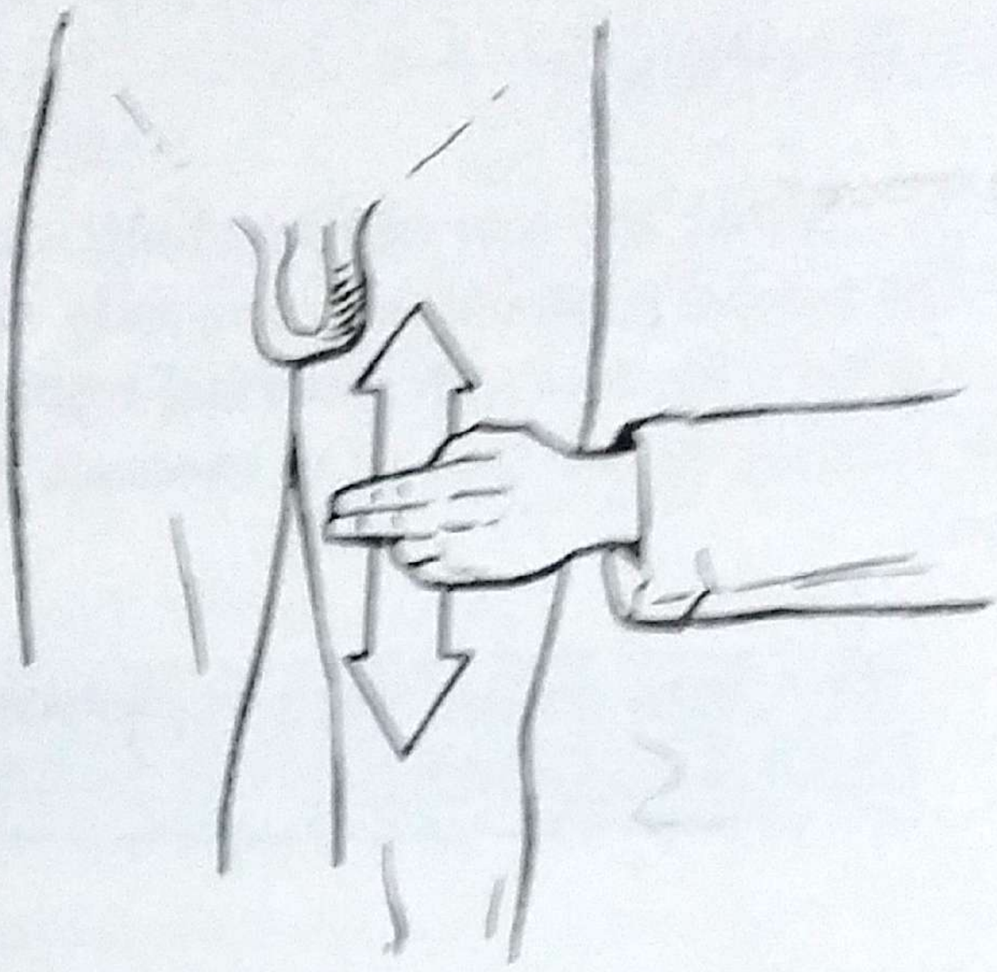


*How to elicit plantar response*

b-Abdominal reflex : stroke the skin toward the umbilicus . The umbilicus should move towards the stimulus .
Assess the reflex in all 4 quadrants of the abdominal wall. The reflex may be absent in the first 6 months of life.

The centre of the reflex is present :
Upper : T8,T9,T10
Lower : T10,T11 ,T12

C-Cremasteric reflex : Stroke the upper inner thigh , the testes will retract toward the inguinal region.

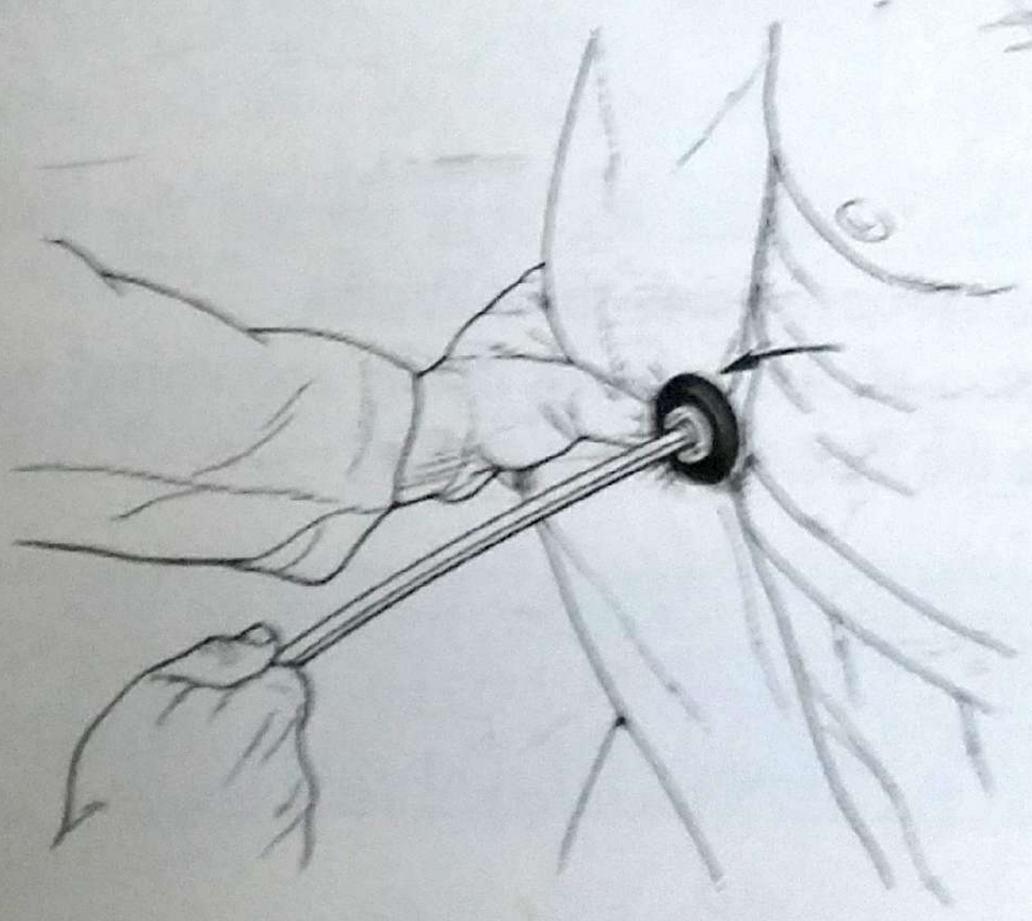


d-Anal reflex : Stimulate the skin in the perianal area→ contraction of the anal sphincter .

## 2) Deep tendon reflexes : Jerks and clonus :

*Biceps jerk* : partially flex the child's forearm. Place your thumb on the antecubital fossa and strike with the hammer→ Flexion of the forearm.

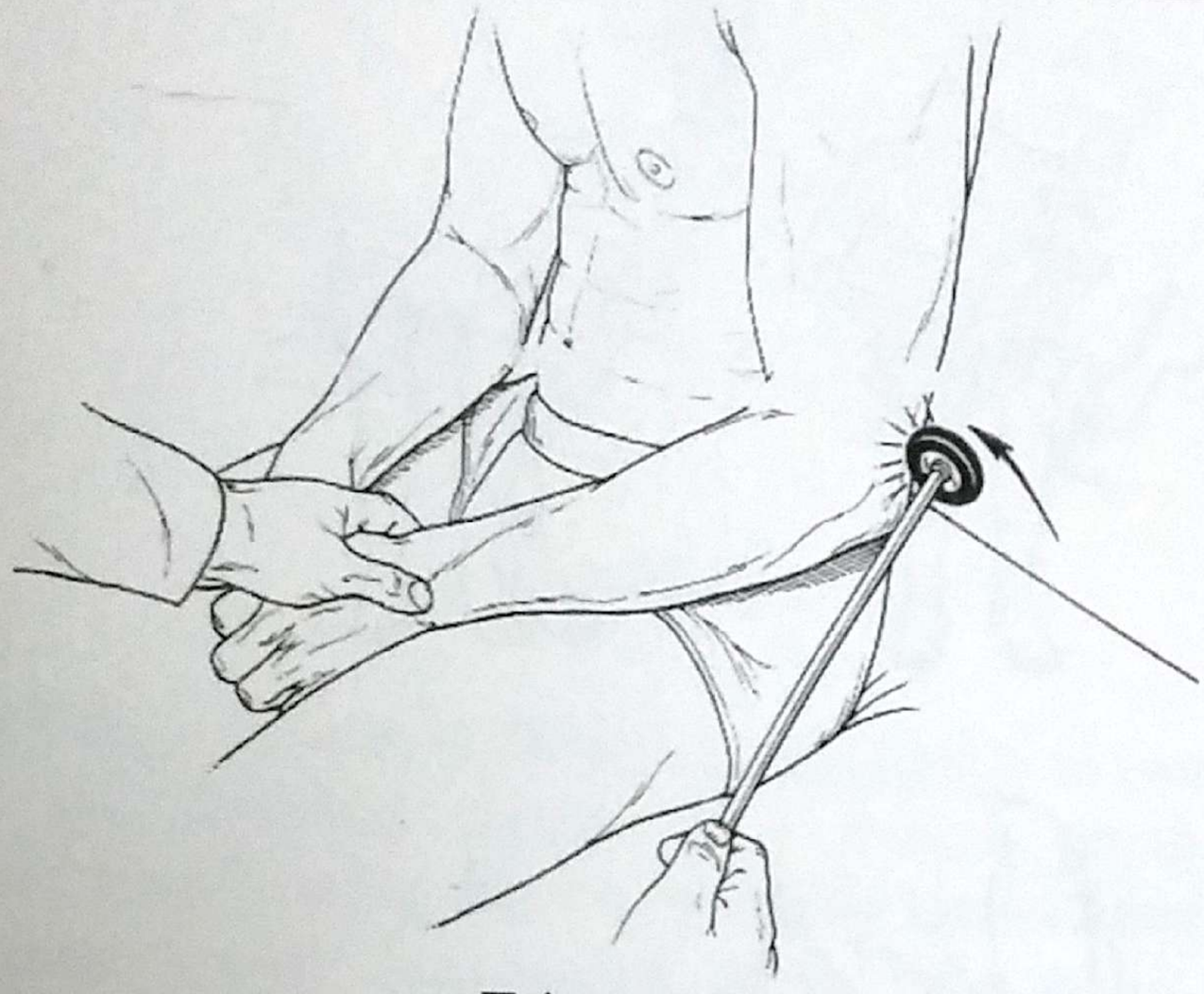
The centre of the reflex is present in C5,C6.



Biceps Jerk

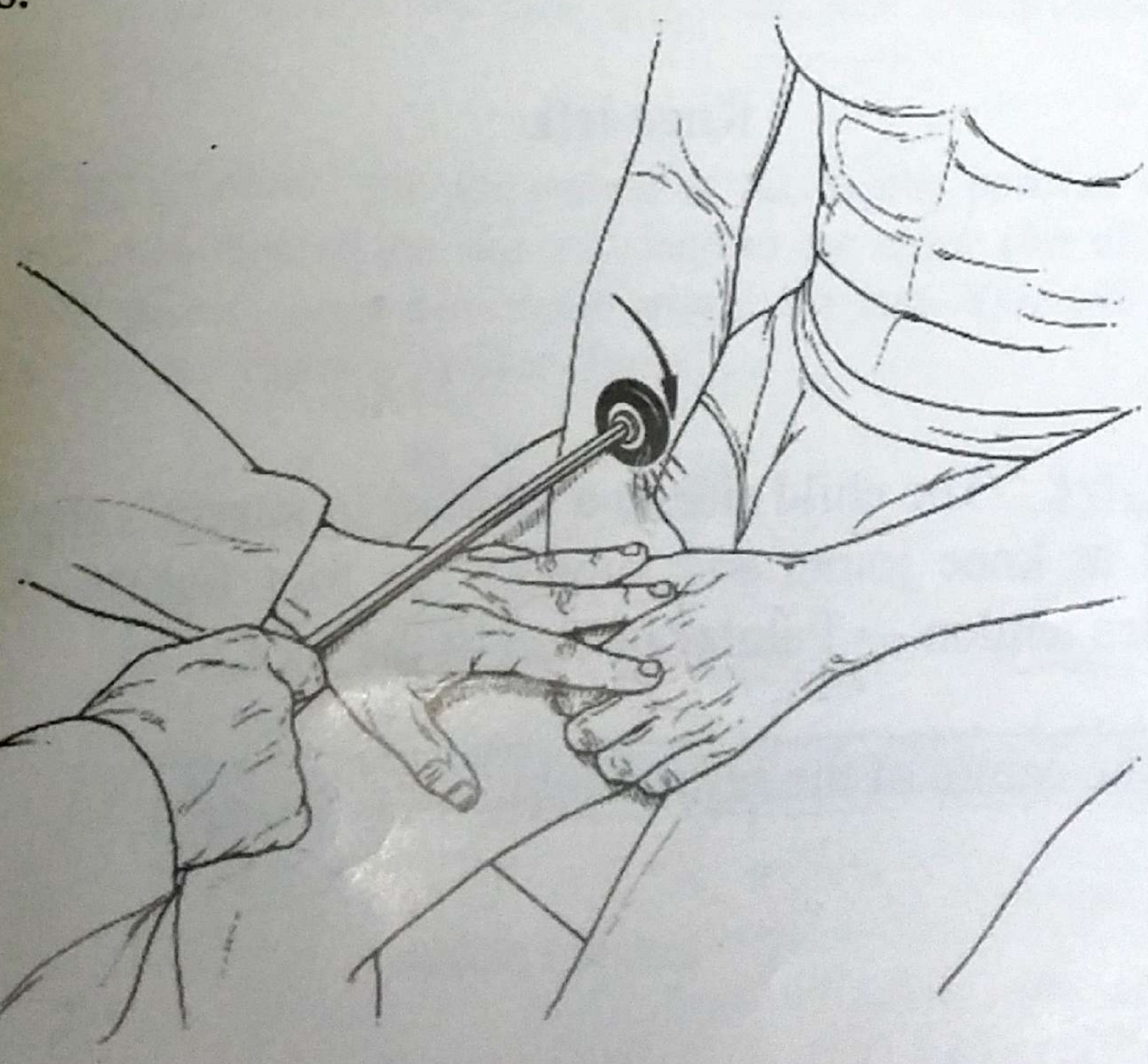
*Triceps jerk :* bend the child's arm at the elbow while supporting the forearm.
Strike the triceps tendon above the elbow . → extension of the forearm.

The centre of the reflex is present in C6,C7,C8



Triceps Jerk

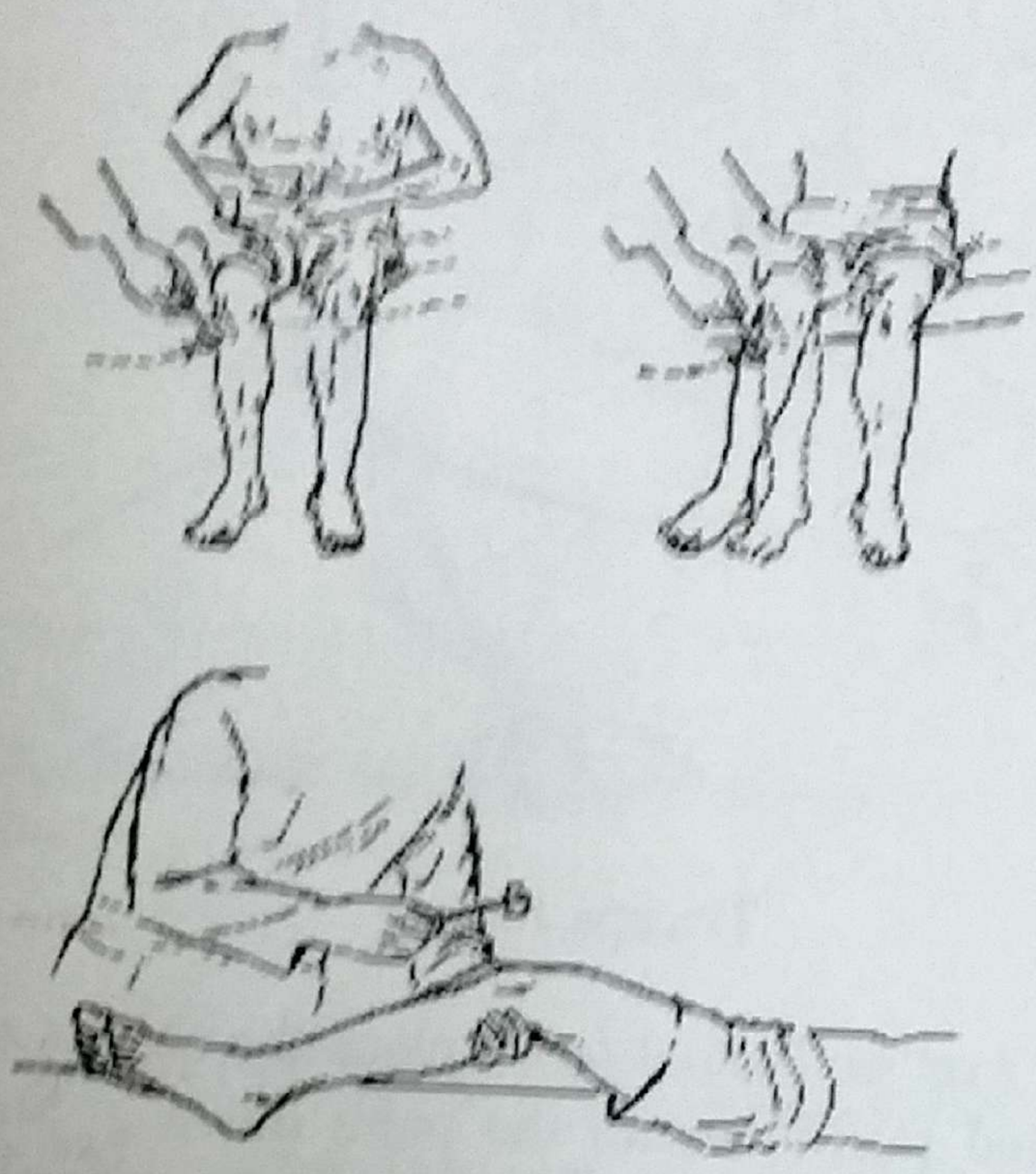
*Brachioradialis ( or supinator) jerk :* place the child's arm and hand in a relaxed position with the palm down . Strike the radius 2.5 cm above the wrist → Forearm flexes and palm turns upwards.



Brachioradialis ( supinator) Jerk

*Knee Jerk :* The child sits on a table or in parent's lap with legs flexed at knee joints. Strike the patellar tendon ( after you feel it properly) just below the patella → The knee extends.

**The centre of the reflex is present in L2,L3,L4**



Knee Jerk

*Ankle jerk :* The child sits on a table or in parent's lap with legs flexed at knee joints and support the foot lightly. Strike the Achilles tendon → Palntar flexion of the foot .

**The centre of the reflex is present in S1,S2**

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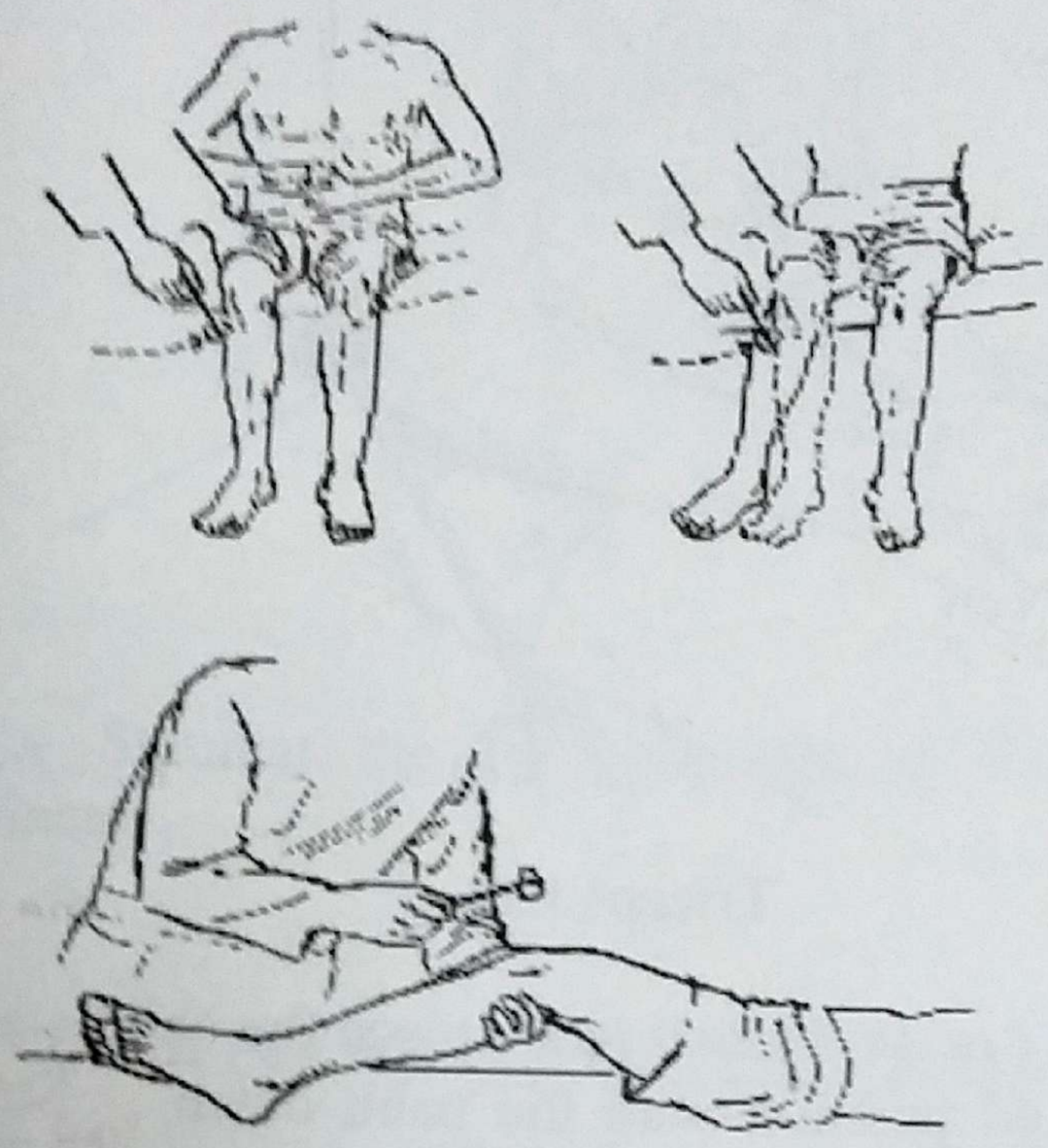

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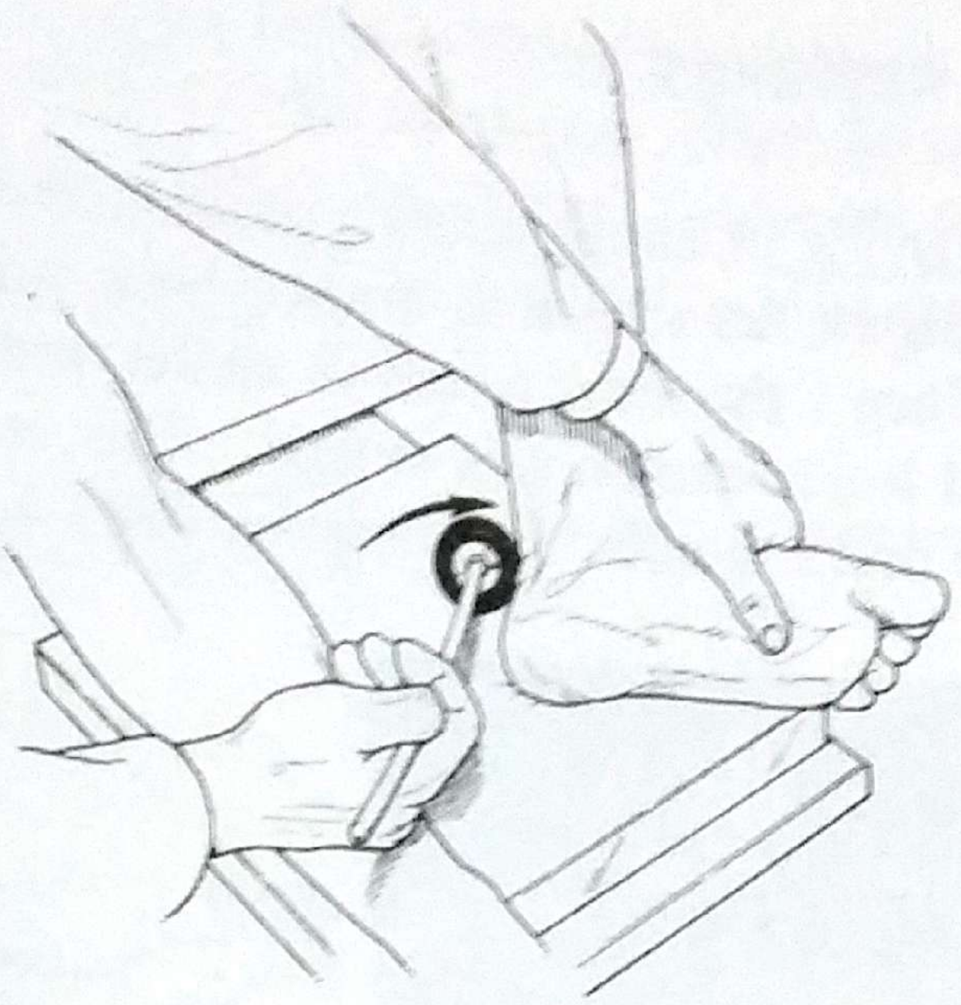
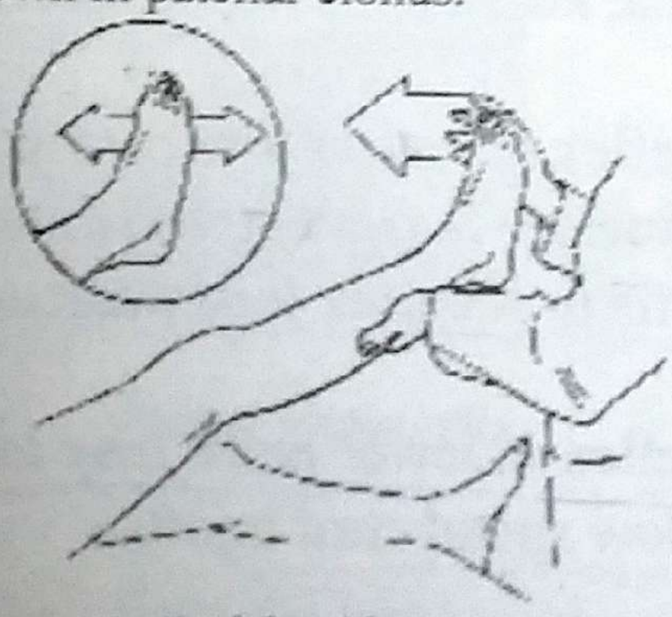


Ankle Jerk

***Clonus :*** Clonus is the regular oscillation of contraction and relaxation on sustained stretch of a muscle group. Sustained oscillations ( usually more than 6 oscillations ) is evidence of an upper motor neuron lesion. Unsustained clonus may occur in anxious persons. The places to look for clonus are the ankle and the knee.

*a- Ankle clonus :* bend the child's knee . Hold the forefoot with the right hand and dorsiflex the ankle in a quick movement . Keep the foot in dorsiflexion without putting too much pressure to achieve this . There is a brief reflex contraction of the calf muscles that then relax. Continued stretch causes a regular oscillation called clonus.

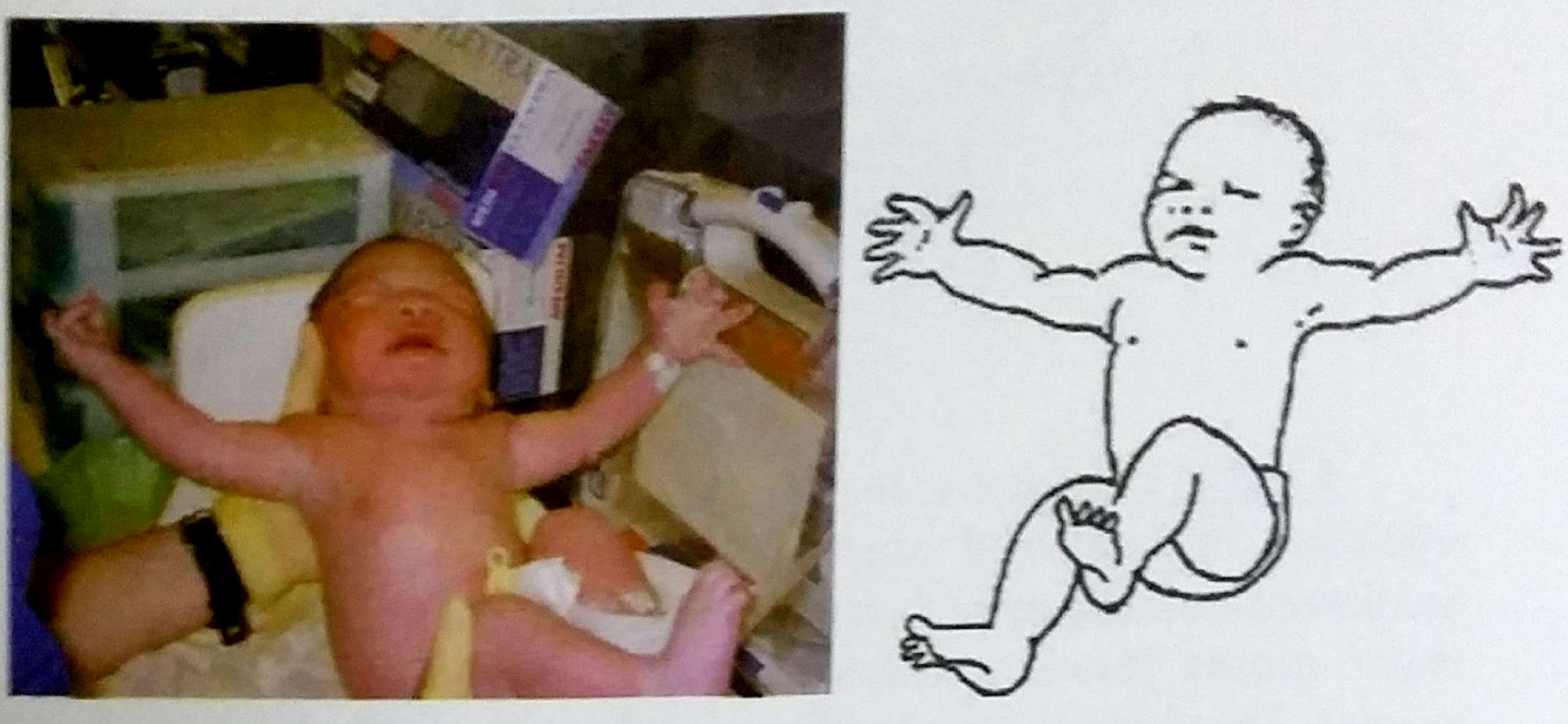
*b-Patellar clonus:* Put the patient in the supine position with knees extended . Pull a portion of the skin proximal to the upper part of the patella Upward . Then quickly push downward toward the feet .You will notice the patella to move up and down in patellar clonus.



Ankle Clonus

## 3) Primitive Reflexes :

*A) Moro reflex :* Change infant's position abruptly→ the arms extend, fingers fan , head is thrown back, and legs may flex weakly. Then , the arms return to center with hands closed . Spine and lower extremeties extend . This reflex is strongest during the first 2 months and disappears at 3-4 months.



Moro reflex

*Significance of Moro reflex :*

-Persistence of the reflex beyond 4 months is suggestive of brain damage.
-Persistence beyond 6 months is highly indicative of brain damage.
-Absence of reflex bilaterally in the first months occurs in hypoxia, septicemia, kernicterus , IC hemorrhage and tetanus.

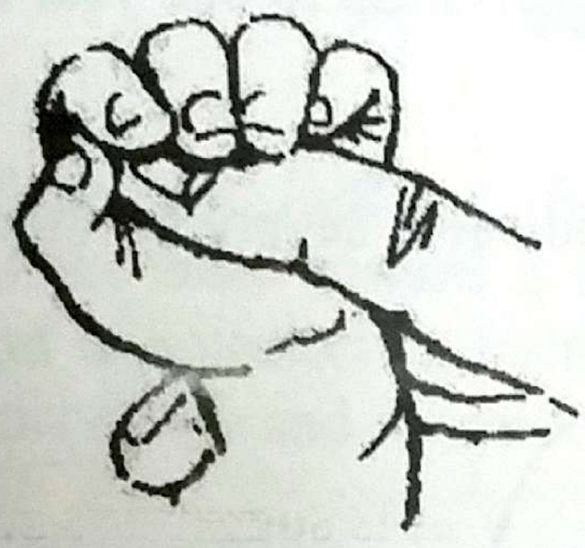
- Absence of the reflex on one side occurs in Erb's paralysis , fracture clavicle, fracture humerus , dislocation of the shoulder joint , septic arthritis in shoulder joint , osteomyelitis.

- Absence of the reflex in lower limbs may indicate congenital hip dislocation or low spinal cord injury.

***B)Palmer grasp reflex :*** Place a finger into infant's palm from ulnar side . If reflex is weak or absent , offer the infant bottle soother as sucking enhances the reflex → infant's finger curve around the finger placed in infant's palm. The palmer grasp disappears by 3-4 months.

Significance : Persistent reflex is indicative of cerebral disorder. Absence of reflex is indicative of paralysis .

***C)Plantar grasp reflex :*** Touch the sole at the base of the toes→ the toes plantar flex . It is present from birth to 6-8 months . Persistence beyond 8 months suggests pyramidal disorder.



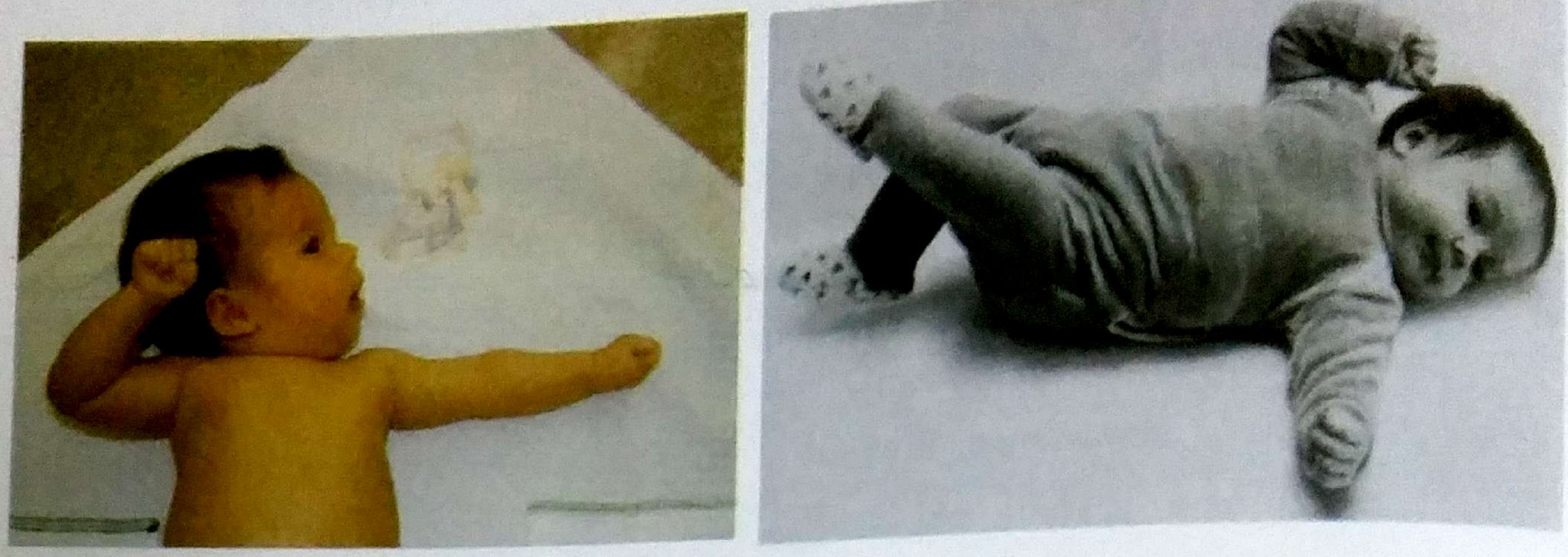
*Palmer grasp reflex*

*Plantar grasp reflex*

*Palmer grasp reflex*

***D)Tonic neck reflex :*** Turn the head to one side→ The arm and leg extends on side to which the head is turned and flex on the opposite side . The reflex appears at 2 months and disappears at 6 months.

Significance: Persistence is indicative of brain damage .



*Tonic neck reflex*

***E) The Rooting reflex :*** Stroke corners of infant's mouth → the infant turns in direction that cheek are stroked . The reflex disappears at 3-4 months, but may persist up to one year during sleep.

Significance : absence of reflex indicates severe neurological disorder.

Rooting Reflex

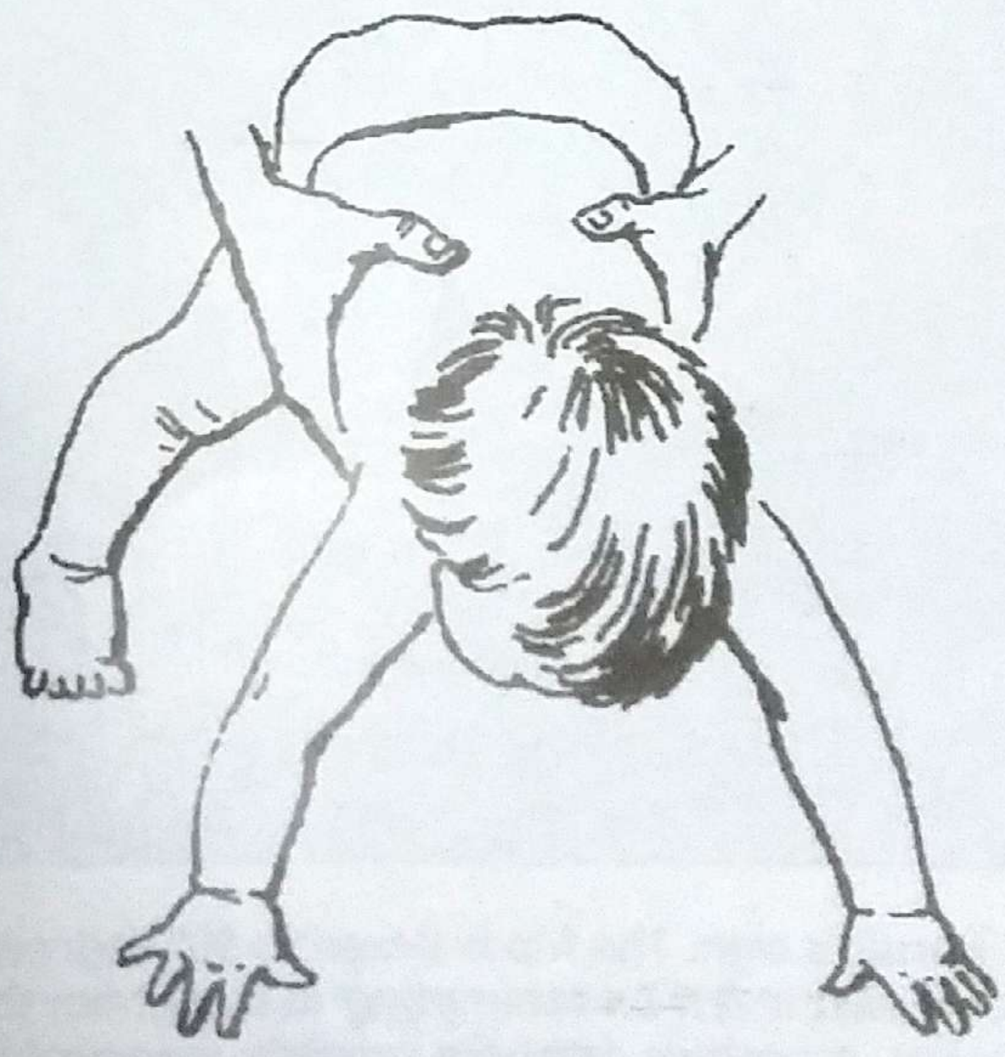
***F) Sucking reflex :*** offer the infant a bottle or soother → the infant sucks strongly in response to stimulation . The reflex persist during infancy and may occur during sleep without stimulation . Weak or absent reflex suggests developmental delay or neurological abnormality.

***G) Stepping reflex :*** Hold the infant so that feet lightly touch firm surface→ the infant's feet move up and down when feet lightly touch firm surface . present in the first 4- 8 week of life. Persistence is abnormal .

Stepping reflex

***H) Parachute Reflex :*** Suspend the baby prone and slowly lower the head toward a surface → The arms and legs will extend in a protective fashion . The reflex starts to appear 4-6 months of age and does not disappear.

Significance : Delay in appearance may predict future delay in voluntary motor development as in cerebral palsy



*Parachute Reflex*

## VI :Signs of Meningeal Irritation :

### 1- Neck stiffness :

-In older children , the examiner can ask the child to flex his neck as fully as he can .

-The examiner can passively flexes the neck while the child is supine. The chin should normally touch the chest without pain .

- In infants, the stiffness is examined by passive flexion only . If the infant is struggling, place the shoulders at the edge of the table , supporting the occiput by hand and flex the neck .

In meningeal irritation , neck flexion causes pain in the neck, sometimes radiating down the back , and the movement is resisted by spasm in the extensor muscles of the neck.

For other causes of neck stiffness , revise neck examination .

### 2- Kernig's Sign :

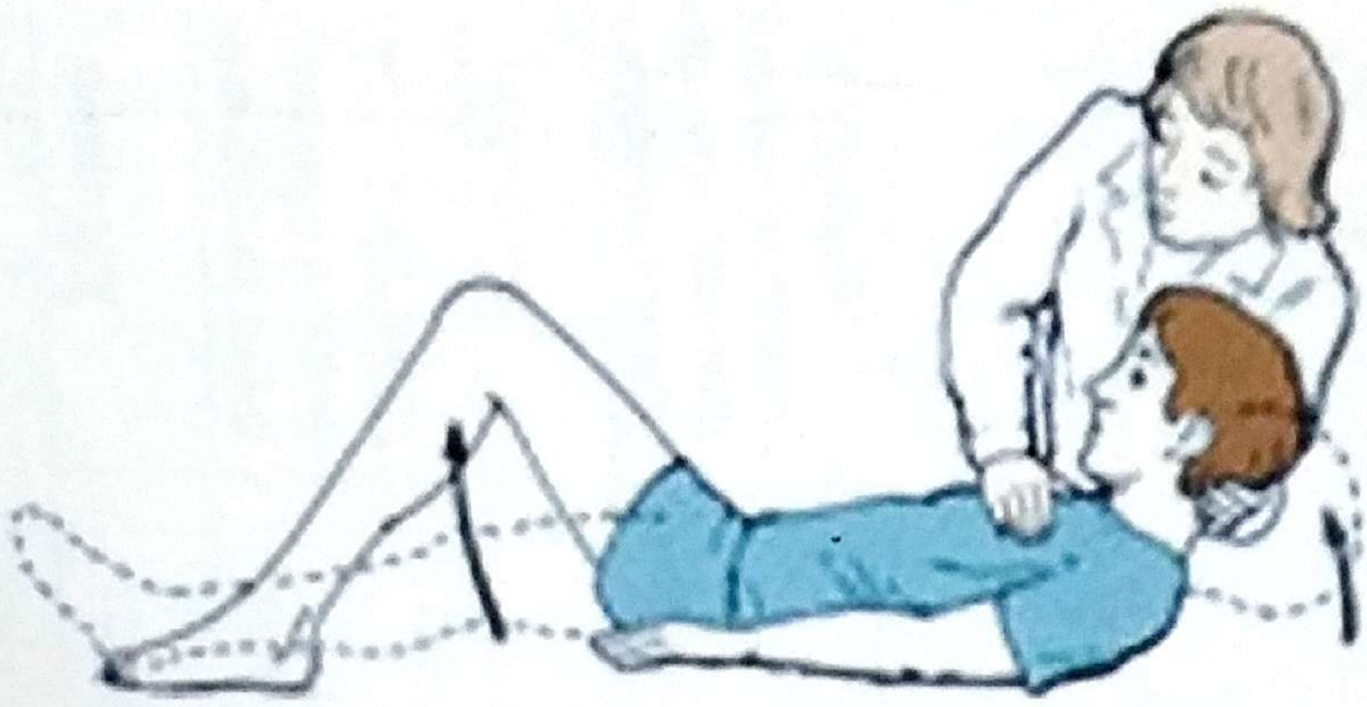
This sign is tested with the patient supine in bed, the hip of the examined lower limb is flexed at right angle and the knee is flexed at right angle. The examiner puts one hand at back of knee to feel tendon of hamstring muscles and tries to extend the knee by the other hand. Trial to extend the knee > 90 → resistance due to spasm of hamstring muscles. or pain.

**11.59 Kernig's sign.** The hip is flexed to 90° degrees with the knee bent; pain is felt on attempting to straighten the patient's leg. A positive response suggests menigeal irritation.

## 3- Brudzinski sign :

*Neck to leg* : with the patient lying supine, neck flexion is associated with flexion of knees and hips of both lower limbs.

*Leg to leg :* Flexion of one lower limb to bring the thigh to abdomen is associated with flexion in the other lower limb .



Brudzinski sign ( neck to leg)

## 4- Stiffness of the back :

- Tripod sign in children : if the child is asked to sit in bed unassisted → the knees flex upward and the patient finds difficulty in sitting up and puts hands on bed to support himself.
- When standing , the child can not flex the back to touch his feet or bring objects from the ground.

- Opisthotonus may be seen in severe cases .

# Physical signs in chest diseases

| | Consolidation | Bronchial narrowing | Collapse | Effusion | Pneumothorax |
|---|---|---|---|---|---|
| **Mediastinal shift** | No | No | Towards the same side | Away to opposite side ( in massive effusion) | Away to opposite side ( in tension pneumothorax) |
| **TVF** | ↑ | ↓ | ↓ | ↓ | ↓ |
| **Percussion** | Dull | Hyper-resonance | Dull | Stony dull | Hyper-resonance or Tympanitic |
| **Breath sounds** | Bronchial | Vesicular breathing with prolonged expiration | Absent or bronchial | Distant vesicular or bronchial according to underlying lung pathology | Bronchial or amphoric |
| **Adventitious sounds** | Crepitations ( fine or medium sized) in early stage or during resolution | Expiratory wheezes | -ve | -ve | -ve |

## Peripheral Signs of Aortic Valve Incompetence :

Peripheral physical signs of aortic insufficiency are related to the high pulse pressure and the rapid decrease in blood pressure during diastole due to blood returning to the heart (the wrong way) from the aorta through the incompetent aortic valve :

**Visible signs :**

- *de Musset's sign (head nodding in time with the heart beat) .*
- *Quincke's sign (pulsation of the capillary bed in the nail, best seen with slight pressure)*
- *Müller's sign (pulsations of uvula)*
- *Becker's sign (pulsations of retinal vessels)*
- *Landolfi's sign (alternating constriction & dilatation of pupil)*
- *Lighthouse sign (blanching & flushing of forehead)*

**Palpable signs** :

- large-volume, with rapid rise and fall 'collapsing' pulse also known as:
  - Water hammer pulse
  - Corrigan's pulse (rapid upstroke and collapse of the carotid artery pulsations)
- *Rosenbach's sign (pulsatile liver)*
- *Gerhardt's sign (pulsations in enlarged spleen with each systole) .*
- *Lincoln sign (pulsatile popliteal artery ).*

**Blood pressure Signs :**

- low diastolic and increased pulse pressure.
- *Hill's sign - a ≥ 20 mmHg difference in popliteal and brachial systolic cuff pressures, seen in chronic severe AI. Considered to be an artefact of sphygmomanometric lower limb pressure measurement.*
- *Mayen's sign (diastolic drop of BP>15 mm Hg with arm raised) .*

**Auscultatory signs :**

- Traube's sign a sharp sound heard over the femoral pulse (pistol-shot sound ).
- Duroziez's sign (systolic and diastolic murmurs heard over the femoral artery when it is gradually compressed with a stethoscope).

# SYSTOLIC MURMUR ON THE HEART (D.D.)

**Innocent murmur:**

1. Timing: Early to mid systolic, short in duration (only the initial 1/3 to 1/2 of systole).
2. Soft, never harsh. Still's murmur may have a musical quality.
3. Intensity: usually of grade I or II.
4. NOT accompanied by thrill and not propagated.
5. Heart sounds are normal.
6. Absence of any cardiac symptomatology.
7. Normal heart radiogram, ECG and echocardiogram.
8. Site:
   - Pulmonary innocent murmur: heard at pulmonary area (2nd left space).
   - Parasternal innocent murmur: heard along the left sternal border.
   - Vibratory (Still's) murmur: heard at mid to low left sternal border or at the $4^{th}$ or $5^{th}$ left space medial to the apex. It is thought to be of aortic origin.
9. Their intensity decreases on assuming upright position and by Valsalva's maneuver.
10. The murmur can be intensified by:
    - Factors which increase the blood velocity and induce tachycardia: e.g.
      * Exercise - Nervousness - Fever - Thyrotoxicosis - Anemia.
    - Factors which decrease the blood viscosity: e.g. anemia.

**II. Pathologic systolic murmurs:**

*1. Mitral incompetence:*

- First heart sound is muffled.
- Second heart sound is normal.
- Murmur:
  * Pansystolic murmur, harsh blowing in character with maximal intensity on the apex.
  * Selectively propagated to the axilla.
  * Not affected by respiration or change of position.

*2. VSD:*

- First heart sound is normal.
- Second heart sound is normal or accentuated if pulmonary hypertension develop.
- Murmur:

* Harsh pansystolic murmur with maximal intensity on third, fourth left intercostal space at the left sternal border.
* Propagated all over the precordium, not affected by respiration or change in position.
* Associated with systolic thrill on left 3rd, 4th space.

3. *PDA:*
   - Continuous machinery murmur with maximal intensity on pulmonary area.
   - Propagate to the left clavicle and down along the left sternal border to the apex.
   - The second sound may be normal or accentuated if pulmonary hypertension develops.
   - Signs of increased pulse pressure are evident as water hammer pulse and Corrigan's sign.

4. *ASD:*
   - Soft ejection systolic murmur on pulmonary area associated with wide fixed splitting of the second sound on the pulmonary area.

5. *Fallot's tetralogy:*
   - A systolic murmur (ejection or pansystolic) is heard best at the third left intercostal space, associated with single second sound (no splitting) on the pulmonary area.

6. *Pulmonary stenosis:*
   - Harsh ejection systolic murmur associated with systolic thrill on pulmonary area. The second sound on pulmonary area is single.
   - Associated with signs of right ventricular hypertrophy as left parasternal lift, epigastric pulsations, dullness on lower half of sternum.

7. *Pulmonary hypertension:*
   - Ejection systolic murmur on the pulmonary area.
   - Accentuated splitted second sound on pulmonary area.
   - Associated with manifestations of right ventricular hypertrophy.
   - Associated with manifestations of the cause e.g. mitral stenosis (mid-diastolic rumbling murmur with presystolic accentuation, opening snap and accentuated first heart sound).

8. *Aortic stenosis:*
   - Weak second sound on the aortic area.
   - Systolic thrill is palpable on the aortic area and propagated to the carotid arteries and suprasternal notch.
   - Harsh ejection systolic murmur on aortic area.
   - Pulse pressure is low.
   - May be signs of left ventricular hypertrophy.

9- *Coarctation of the aorta :*
   - A systolic murmur is heard at the aorti carea, suprasternal notch and interscapular area.
   - Apex is left ventricular.
   - Femoral pulse is weak or absent.
   - Hypertension in upper limbs and low pressure in lower limbs. Normally the blood pressure is higher in lower limbs.
   - Collateral circulation may be seen around the scapulae.

10. *Tricuspid incompetence:*
   - First heart sound is muffled.
   - Second heart sound is heard.
   - Murmur:
     * Harsh pansystolic murmur with maximal intensity on tricuspid area.
     * Not propagated to the axilla.
     * Increased with inspiration and no change wit change in position.
   - Associated with hepatojugular reflux.
   - Associated with enlarged pulsating liver.